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BY

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AND

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PREFACE TO THE FOURTH VOLUME.

The manner in which the members of the medical profession have received the previous volumes of the Annual and Analytical Cyclopædia of Practical Medicine has been so encouraging that it is with renewed pleasure that the editor places the fourth issue before his readers. The marked success implied has not only been due to the novel plan of the work,—a general article upon each disease, sustained by the salient points of the literature of the last ten years,—but also to the excellence of the general articles (presented in large type) written by the members of the associate staff. To all of these gentlemen the editor wishes, therefore, to renew his expressions of gratitude.

It is with deep sorrow that the editor must record the death of his friend, Professor George H. Rohé, of Baltimore, who had been connected with the Annual since 1891. To enumerate his qualities would imply that he had faults. Those who knew him well could but conclude that if we were all of his kind the world would be one where generosity and affection would reign supreme. One of Dr. Rohé's last contributions appears in this volume: a review on the subject of "Insanity," calculated to clearly define the practical aspect of the various mental disorders, not only for clinical purposes, but for the court-room. How thoroughly our departed friend has accomplished his task the reader will appreciate. It is in keeping with the sincerity of purpose that characterized him.

This volume contains, besides the article on "Insanity," a timely paper on the "Diarrhœal Diseases of Infants," by Professor Blackader, of Montreal. During the coming summer its great scientific value will doubtless be recognized. An elaborate paper on "Malarial Fevers," by Professor James C. Wilson and Dr. Thomas G. Ashton, will also, it is hoped, receive the great appreciation to which it is entitled. The article on "Locomotor Ataxia," by Dr. W. B. Pritchard, of New York; that on "Intubation," by Professor F. E. Waxham, of Chicago; and that on "Diseases of the Liver," by Professor Alexander McPhedran, of Toronto; that on "Meningitis," by Dr. Charles M. Hay, of Philadelphia, are also entitled to special notice as models of their kind. The editor must express his regret that through unavoidable circumstances he was obliged to write the article on "Leprosy" himself, and at the last moment. Still, the fact that he has had the opportunity of seeing quite a number of cases during his travels and the important rôle played by the upper respiratory tract in the etiology of the disease lead him to hope that he may have treated the subject with a certain degree of competence.

The Editor.

2043 Walnut Street,
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Sajous's Annual

AND

Analytical Cyclopædia of Practical Medicine.

I

INFANTS, DIARRHŒAL DISEASES OF.—Gr., from διά, through, and ῥεῖν, to flow.

Definition.—Diarrhœa in itself can be regarded as a symptom only: a symptom indicative of increased motor activity and of increased, and perhaps perverted, secretory activity in the intestinal canal.

Disturbance of the intestinal activity is sometimes due merely to the presence in the alimentary tract of irritating and noxious material and the increased secretion and peristalsis is to be regarded as an effort of nature to get rid of offending material; an effort which, if effective, and not unduly severe or prolonged, must be considered as entirely salutary in its character. More frequently, diarrhœa, especially in infants, must be regarded as one symptom only of an intoxication of the system by toxins the product of pathogenic micro-organisms present in the alimentary canal: a symptom important in itself, but not to be considered apart from other symptoms of systemic intoxication,—such as fever, quickened and enfeebled cardiac action, and nervous prostration.

In many of these cases inflammatory changes more or less extensive in character are set up in the walls of the intestines; such changes may be due to some extent to the abnormal and irritating character of the intestinal contents, but, to a much greater degree, they result from the specific action of the bacterial toxins. In some instances the bacteria themselves appear to penetrate the tissues of the intestinal wall; destructive changes are thus induced which not only aggravate the general symptoms, but, should the case survive, indefinitely retard recovery.

Owing to the abnormal activity of peristalsis by which food is unduly hurried through the alimentary tract and to an alteration in the various digéstive fluids, either quantitative or qualitative, the process of digestion is performed more or less imperfectly; owing, also, to inflammatory changes in the walls of the intestine, absorption is hindered and general nutrition becomes rapidly impaired. In some cases, where the diarrhœa is of a grave character, or persists throughout a long period of time, the emaciation becomes extreme.

Diarrhœa is thus of much importance as a clinical symptom; for this reason it has long been customary to group together under the name used generically all those disorders which have, as their prominent and most important symptom, an increased motor and secretory activity

of the intestinal tract from whatever cause arising. This use of the name lacks scientific precision; nevertheless, while our knowledge of many of the conditions met with in these disorders is still inexact and uncertain, it does not seem wise to attempt more precise definition.

Infants under the age of thirty months are peculiarly prone to diarrhœal disorders. In such infants disorders of the intestinal tract present an etiology and pathology peculiar to themselves, and in them, to a much greater extent than in older children or in adults, has the disease a tendency to run a severe course, and in a large proportion of cases to terminate fatally. For this reason the subject of infantile diarrhœa claims separate consideration.

Etiology.—If we inquire into the causes which induce this liability to diarrhœal disease on the part of infants, a few facts stand out prominently.

The Season.—The diarrhœas of infancy take a comparatively unimportant rank among infantile diseases during the cooler months of the year, but with the onset of warm weather they suddenly acquire importance, owing to their general severity, to their large mortality, and to the frequency with which they are encountered. This is evidenced by the statistics of all large cities in the temperate zones. Whenever the minimum temperature of the atmosphere for the twenty-four hours reaches the neighborhood of 60° F., infantile diarrhœas assume the character of a wide-spread epidemic. An attempt has been recently made by some English physicians to connect the epidemic character of the disease with the temperature of the soil. Dr. Ballard, after careful investigation, states that the mortality from this class of disorders does not begin until the thermometer registers a temperature of 56° F. four feet below the surface. That there is any relation of cause and effect between the two facts, however, has in no way been proved.

Age.—An investigation of the age of children thus attacked reveals the fact that the great majority are under 2 years. Holt has given us the statistics of 3000 cases of diarrhœa treated in family and dispensary practice, classified according to age.

He finds that, of the total number, infants under 6 months form 14 per cent.; infants from 6 to 12 months, 29 per cent.; infants from 12 to 18 months, 24 per cent.; infants from 18 to 24 months, 17 per cent.; and children over 2 years, 16 per cent. In France, Lesage places the age of special liability as under 18 months and regards the first 3 months, and also the period between the eighth and ninth months, when weaning is generally commenced, as specially dangerous.

The age at which diarrhœal diseases are most prevalent has been investigated by the writer. In 3000 cases occurring in New York City the ages are shown in the following table:—

	Cases.	Percentage.
First six months.....	413	13.7
Second six months.....	873	29.1
Third six months.....	722	24.1
Fourth six months.....	514	17.2
Over two years.....	478	15.9
Under two years.....2522		84.1
Between six and eighteen months.....1595		53.2

Crandall (Archives of Ped., Nov., '90).

Literature of '96-'97-'98.

A recent report of the Health Board of New York City shows that there was for one year 2789 deaths from diarrhœal affections, and of these deaths 92 per cent. occurred in children less than 2 years of age. Gilbert (Amer. Pract. and News, Oct. 16, '97).

Diarrhœa appears to be most frequent

among children under one year of age. In England and Wales in 1894 the deaths of children from diarrhœa under five years old amounted to 9005. Of these, 7360 were infants under one year; 1332 occurred during the second year; while, in the third, fourth, and fifth years combined, there were only 313. Again, in London, 72 per cent. of all fatal diarrhœas occur in the first year of life. Langford Symes (Dublin Jour. Med. Sci., May, '97).

Mode of Feeding.—It is the experience of every physician who has kept a record of his cases that fatal, or even severe, cases of diarrhœa among infants fed entirely at the breast are extremely rare. Holt emphasizes this, when he says that, of 1943 fatal cases of which he has collected the records, only 3 per cent. were breast-fed exclusively. He refers the partial immunity which, according to his statistics, infants under six months enjoy to the fact that the great majority of such are breast-fed, and in this way obtain a sterile and digestible food. With the commencement of artificial feeding, gastro-intestinal disorders at once acquire prominence. Too often the food substituted for breast-milk is more or less difficult of digestion, defective in composition, and liable to be supplied to the infant too frequently or in too large amounts, in this way setting up indigestion: the most important predisposing cause of infantile diarrhœa. But, as we all know, the materials supplied as food to the infant may be of the most faulty character, inducing indigestion, colic, and malnutrition in one or other of its various forms, and yet during the cool season we meet with either no diarrhœa or diarrhœa of a temporary and easily controlled form.

Healthy infants have a normal tendency to loose, liquid, and semiliquid evacuations from the bowels: (1) partly from the condition of the intestinal tract; (2) partly from the nature of normal food, *i.e.*, breast-milk. Peristaltic movements in the healthy child are very active. Young blood- and lymphatic vessels are very permeable and the transformation of the surface-cells active and rapid. The peripheral nerves are very superficial, more so than in adults, whose mucous membrane and submucous tissue have undergone thickening by both normal development and morbid processes. Besides, the action of the sphincter ani is not very powerful. Fæces are not retained in the colon and rectum, and little time is afforded for the reabsorption of the liquid or dissolved fæcal contents. Frequency of acids (sometimes normal) in the small intestine gives rise to formation of alkaline salts with purgative properties. Free acids when found in the intestine show that (1) the quantity of food is too large; (2) the quantity of digestive fluid is too small, causing fermentation instead of normal digestion. Louis Fischer (The Post-graduate, Sept., '92).

Of 58 deaths among children entirely raised by mothers' milk none had uncooked fruit given them. In 6 of these cases the mother herself had eaten uncooked fruit. In 2 instances 1 of the mothers had eaten boiled apples and the other cauliflower; so that there were 8 out of 58 cases in which fruit might be regarded as connected with the child's diarrhœa. Of 135 children under 3 years of age, not at the breast, whose deaths were inquired into, 2 ate fruit; the remaining 133 are distinctly stated not to have had any.

Of the 605 fatal cases of diarrhœa in Leeds in 1893, 66 per cent. occurred in houses either without drains or with drains not properly severed from the sewer, and one-fifth of the remainder (making 73 per cent.) had other sanitary defects. It is to the feeding-bottle and to the infection of its contents rather than to fruit that attention must be most especially directed in the prevention of autumnal diarrhœa. J. S. Cameron (Lancet, June 30, '94).

Literature of '96-'97-'98.

Infective diarrhœa sometimes rages as an epidemic. It practically never occurs

in breast-fed children (at least in only 3 per cent). Neglect or deficiency of ventilation seems to be a very important cause, and the bacteria in question appear to inhabit the superficial layers of the earth, becoming wide-spread when the temperature reaches 58° F. Langford Symes (Dublin Jour. Med. Science, June, '97).

Defective water-supply appears to affect the children over 5 years of age, but infants are swept away in hundreds by milk which is infected or contaminated. The greater number of fatal diarrhœas are doubtless due to artificial feeding. All organisms grow and flourish in milk. Symes (Brit. Med. Jour., May 8, '97).

For the exciting cause, therefore, of the severe diarrhœas of infancy we must seek further; such a cause, it is now almost universally conceded, exists in the growth in the intestinal tract of toxin-producing bacteria. Such bacteria, probably, in the majority of cases are introduced with the food. During the colder seasons of the year these bacteria, while present more or less everywhere, remain quiescent, but, with the onset of warmer weather they multiply in any suitable medium with a rapidity almost incredible. No article of infant-diet appears to be so readily contaminated as cows' milk; not only is it liable to be infected from many sources, but at the same time it affords an excellent culture-medium for almost all forms of bacteria. Hence to it, more than to any other article of diet, are disastrous effects attributed. Moreover, it was formerly supposed that the acidity of the gastric juice, in the infant as in the adult, stood guard with a certain amount of germicidal power at the portal of the intestinal tract, where, even under normal conditions, there appears to be little hindrance to bacterial growth. Traube and Escherich, however, have shown that in young infants the stomach has but slight power of either digestion or absorption, and is rather a receptacle into which the milk is received for coagulation, and from which it quickly passes into the small intestine, where it meets the proteolytic ferment of the pancreas, relatively well developed even at an early age. Owing to this there is practically no hindrance to the development of bacteria in the alimentary tract of the infant, save the rapidity and completeness with which the digestive process is performed. Indigestion, therefore, by permitting fermental changes, furnishes the conditions under which any pathogenic bacteria, either just introduced by means of contaminated food or present in the canal but previously hindered in development, may flourish and evolve their poisonous toxins.

As additional predisposing causes, we may add that all conditions which lower the vitality of the infant tend to impair digestion, and, to this extent, favor the development of diarrhœa. Defective hygienic conditions, previous acute disease, and malnutrition in all its forms, especially rachitis, syphilis, and tuberculosis, appear to act in this way. Summer-heat directly prostrating the nervous system, overexcitement, and occasionally the nerve-irritation accompanying dentition, have all an influence more or less disturbing on digestion, and may, therefore, be regarded as predisposing causes of diarrhœa.

General Pathology. — The normal fæces of a healthy infant fed at the breast should be of a smooth and homogeneous nature, of semisolid consistence, of a dull-lemon color, and of a not unpleasant odor. They should have an acid reaction, due to the presence of fatty acids and of a small amount of lactic acid. Fat, chiefly in the form of neutral fats, fatty acids, and soaps, is almost always present,

sometimes in considerable amount. Sugar is never present. Proteids, in breast-fed children, are present in small amount; but, in infants fed on cows' milk, casein is met with in considerable quantity, rendering such motions firmer in consistence, paler in color, larger in amount, and with a distinctly more unpleasant odor. In breast-fed infants, under normal conditions, the bile-elements for the most part remain unaltered, but, as the diet becomes changed, the biliary pigments become decomposed, and, with the mixed diet of the second and third years of life, the fæces resemble those of the adult, excepting that they are less firm and more or less acid in reaction. Mucus is present to a considerable extent; also epithelial cells, chiefly of the columnar variety.

Under the influence of diarrhœal conditions, the fæcal discharges become much altered. At the onset, and persisting so long as due attention is not given to the feeding, undigested food is always more or less present. Masses of casein are frequently seen, and may be easily recognized; fat may be present in small yellowish-white masses, somewhat resembling the former in appearance, but distinguished by solubility in ether. Unchanged starch may be recognized by the iodine test. The number of the discharges during the twenty-four hours may vary from four or five to twenty or more. Their odor is probably dependent upon the character of the fermentation present. When sour, an acid fermentation, and, when very offensive, albuminous decomposition is supposed to exist. The reaction is almost invariably acid; only when the discharges are more of an exudative than of a fæcal character does the reaction become distinctly alkaline. The color is very variable. The most noticeable change is to a varying shade of green, due, according to Wegscheider, to the conversion of bilirubin into biliverdin. Lesage, however, states that this green color is not always due to biliverdin, but is sometimes due to a chromogenic microbe of which the pigment stains the stools; other observers, however, have not verified this statement. The amount of mucus is almost always increased, in some instances very largely so; when it is seen in quantity, it generally indicates a local congestion of the lower portion of the colon. Blood is occasionally seen, due sometimes to ulceration, but more frequently to local congestion and straining.

At birth, the intestinal tract of the infant is free from bacteria. This condition, however, is quickly changed, and even in otherwise healthy infants, many forms may be found in the fæcal discharges a few days after birth. Under normal breast-feeding, however, and with good digestion, two varieties of bacilli are constantly found, and, for this reason, have been termed the constant, or obligatory, forms of healthy-milk fæces; they are the bacilli coli communes and the bacilli lactis aërogenes. The latter abound in great numbers in the upper part of the small intestine, where they appear to thrive in the yet-imperfectly-digested milk-curds. In the lower part of the small intestine and upper part of the colon they are met with in gradually diminishing numbers, while the bacilli coli communes, which in the small intestine are found only in comparatively small numbers, now multiply rapidly; so that in the lower part of the colon and in the fæces they greatly predominate over the preceding form and over other less constant varieties.

When breast-feeding is replaced by a more mixed diet, other forms of bacteria are found in variable numbers and

in an inconstant way; among those frequently met with are the streptococcus coli gracilis, various forms of micrococci, various liquefying bacilli, and the bacillus subtilis.

In the discharges of diarrhœa some new forms make their appearance in great abundance, but, with the exception of the two before mentioned as always present, no one variety is so constantly met with as to permit it to be regarded as a specific cause. From several of these inconstant forms, however, Vaughan has isolated proteid substances, which when injected in very minute quantities under the skin of animals produce poisonous symptoms, such as vomiting and purging, with elevation of temperature, and in larger doses collapse and death. The question as to whether either of the obligatory forms under the abnormal conditions met with in diarrhœa develop pathogenic properties, though much discussed, can scarcely be said to be definitely settled. Of one, the bacillus coli communis, recent studies indicate that it may undoubtedly at times develop virulent pathogenic properties.

Booker, to whom the medical world is indebted for a careful investigation of this subject, states that in infantile diarrhœa the conditions for the development of bacteria in the intestinal canal appear to differ from those obtaining in the healthy intestine of milk-fed infants. The bacterial forms present a greater variety; forms met with only occasionally and in small numbers in the healthy intestine are now much more pronounced, and frequently appear in immense numbers; while the bacillus coli communis and the bacillus lactis aërogenes become more uniformly distributed through the intestine. No single species of micro-organism is met with sufficiently frequently to be regarded in itself as the specific exciter of diarrhœa; but among the many forms encountered several varieties of streptococci and the proteus vulgaris appear to be of special importance. The streptococci are met with frequently; occasionally seen in the stomach and upper part of the small intestine, they become much more abundant in the lower ileum and colon, especially in those cases where ulceration of the mucosa is going on. So constantly and in such large numbers are they found in these cases that it is reasonable to suppose that they play an active and important rôle in the ulcerative process. Of the proteus vulgaris, Booker says that it is found in more than half of the severer cases of diarrhœa; in the milder forms it is seldom met with. Cases in which this bacillus abounds present a different type of symptoms to those in which streptococci prevail; the patients more frequently show toxic phenomena and have watery or pasty stools with a putrid odor, but without evidence of serious inflammatory trouble in the intestine.

Among other forms of bacteria possessing pathogenic properties encountered we may mention the staphylococcus pyogenes, the bacillus pyocyaneus, the bacillus mesentericus, and the bacillus enteritidis (Gärtner). Such forms probably more or less modify the symptoms in special cases.

Although at birth the contents of the digestive tract are sterile, bacterial infection is brought about within the first twelve hours of life through the medium of the atmospheric air which the infant swallows in large quantities. The various micro-organisms thus introduced into the system thrive and multiply in the mucus and undigested food which soon fill the intestine, and are constantly reinforced in numbers and diversified in species by the ingestion of contaminated milk or the swallowed secretions of the

mouth. The danger which arises from these natural sources of infection is greatly increased by the fact that during infant-life the gastric juice is incapable of exerting any decided control over microbic growth, owing to its comparative deficiency in free hydrochloric acid. The entrance of undigested and fermenting material into the intestine induces violent peristalsis, with the result that the infant suffers from colic and diarrhœa until the bowel has succeeded in ridding itself of its irritating contents. If proper means are taken to assist Nature and to prevent a recurrence of the disorder, the stools soon resume their normal appearance and perfect recovery ensues. But if these evidences of digestive derangement are overlooked, gastro-intestinal catarrh supervenes. This inflammatory condition probably arises from direct irritation of the mucous membrane of the digestive tract by acid products of fermentation, and since it is always accompanied by a diminution in the secretion of hydrochloric acid, gastric digestion becomes greatly enfeebled, and the various bacteria are afforded an unlimited scope of action. Within a short period of time the intestine becomes affected in a similar manner, and the child begins to lose flesh and strength and to present all the symptoms characteristic of chronic intestinal catarrh. The third and last stage of the disease is marked by a more or less extensive cirrhosis of the mucous membrane of the digestive tract, often associated with the follicular ulceration of the colon. The diarrhœa continues and the stools are largely mixed with mucus or streaked with blood; the marasmus increases, and death finally ensues either from exhaustion or from some nervous phenomena due to the absorption of toxins from the alimentary tract. W. Soltau Fenwick (Brit. Med. Jour., Dec. 21, '95).

[Fifteen varieties of bacteria have been isolated from the stools of children suffering from summer diarrhœa, in addition to the B. coli commune and B. lactis aërogenes of Escherich, and the forms are not yet exhausted. The great majority of the bacteria belonged to the group classed as saprophytic. No constant form was found, and no one form predominated in a large proportion of the cases. Baginsky, Cor. Ed., Annual, '91.]

The development of intestinal bacteria depends quite as much, if not more, upon the character of the bowel and its contents than upon the accidental presence of this or that bacterium. Carter (Provincial Med. Jour., May 1, '93).

Literature of '96-'97-'98.

Study of the stools clearly showing that no single species of micro-organism is responsible for the disease, and also, in a general way, that the character of the passages and the nature of the systemic disturbance conform to the character of the intestinal infection.

In a considerable number of these cases the obligatory milk-fæces bacteria were found to be the chief bacterial ingredient of the stools. These were for the most part mild cases, of short duration, and usually without apparent toxic symptoms. The stools were sometimes very frequent, were usually acid in reaction, and lacked uniformity of consistence, having been often lumpy. They contained no leucocytes. Twenty-four cases of this type were studied. Bacillus coli communis and bacillus lactus aërogenes preponderated. Other bacteria when present appeared in very small numbers and were apparently insignificant. In all these cases bacillus coli preponderated in the stools over bacillus lactis.

In another set of cases, represented by six only of the ninety-two, while the obligatory milk-fæces bacteria, were greatly increased in number, the inconstant bacteria of the normal intestinal contents preponderated and appeared to play an important *rôle* in the induction of the symptoms. Thus, in three of the cases "bacillus a" was the most notable feature, and in one each "bacillus x," "bacillus y," and "bacillus d." These are the designations applied by the writer to four of the numerous inconstant milk-fæces bacteria of infants described by him in a former paper, several of which were found to be pathogenic to animals, and have since been shown by Vaughan to elaborate toxic substances when grown

in broth. These cases were all severe and presented evident toxic symptoms. The stools were frequent in some, infrequent in others, and varied much in consistence. They often had a decidedly putrid odor. One of these cases in which "bacillus x" preponderated was fatal.

A third set of cases, comprising thirty-five, was characterized by enormous numbers of bacilli in the stools, among which proteus vulgaris was always found in large numbers. The ordinary obligatory milk-fæces bacteria were also constantly present in very great excess of the normal, and in many of the cases a few streptococci and some other inconstant forms were also present. These were serious cases, usually chronic if not fatal, and characterized by emaciation and toxic symptoms. The stools were, as a rule, liquid, yellow or green in color, putrid, and neutral or alkaline in reaction. They seldom, however, contained mucus, leucocytes, or epithelium.

In the fourth and last set of cases, twenty-seven in number, micrococci preponderated in the stools, though in addition bacillus coli was present in increased number in all the cases, bacillus lactis in fourteen, and proteus vulgaris in four. The micrococci were for the most part streptococci. These cases were uniformly severe, and gave evidence of marked toxic disturbance. The stools were, as a rule, very frequent, often more than twenty in the twenty-four hours. They were soft or liquid, often greenish, and usually contained mucus and leucocytes in abundance. They were also at times very offensive. Though very numerous, the bacteria were not present in the stools in the enormous numbers met with in the third set of cases. Stained cover-glass preparations also showed them to be chiefly micrococci, not bacilli, as in the former cases. A general pyæmic infection was a not infrequent outcome of these cases. Booker (Johns Hopkins Hosp. Reports, vi, 159, '96).

The diarrhœal disorders of childhood arising under the influence of high summer temperature are at first only functional in character, but in their further course profound anatomical alterations take place in the walls of the stomach and bowels, which may range between catarrh and necrosis of the mucus membrane. These changes are attributable not to specific bacteria, but to the ordinary saprophytic micro-organisms of the intestinal tract that assume especial virulence. The invasion of other organs by these bacteria is not unusual. The most profound disturbances are occasioned by the fermentative products of bacterial activity, toxic or non-toxic. Under the influence of this intoxication from the intestinal tract the resistance of the whole organism to the invasion of other pathogenic micro-organisms is diminished, as is manifested by numerous complications. Baginsky (Archiv f. Kinderh., B. 22, 113-6, '97).

Literature of '96-'97-'98.

Conclusions based upon a study of thirteen cases of infantile diarrhœa:—

1. The bacterium coli appears to be the pathogenic agent of the greater number of summer infantile diarrhœas.

2. This organism is the more often associated with the streptococcus pyogenes.

3. The virulence, more considerable than in the intestine of a healthy child, is almost always in direct relation to the condition of the child at the time the culture is taken and does not appear to be proportional to the ulterior gravity of the case.

4. The mobility of the bacterium coli is, in general, proportional to its virulence. The jumping movement, nevertheless, does not correspond to an exalted virulence in comparison with the cases in which mobility was very considerable without presenting these jumping movements.

5. The virulence of the bacterium coli found in the blood and other organs is identical to that of the bacterium coli taken from the intestine of the same subject. C. G. Cumston (Inter. Med. Mag., Feb. and Mar., '98).

The anatomical lesions met with in the intestinal tract of the infant, as the result of the diarrhœa, are of a varied character and are due apparently to the intensity of the irritant and the period

of time during which its action has persisted. Nevertheless, it must be acknowledged that there is frequently a surprising want of relation between the post-mortem evidence of disease and the severity of the clinical phenomena and *vice versâ*: a lack of relation, which thus far pathologists have not satisfactorily explained. Attempts have been made at a classification, but it is generally admitted that although cases may be grouped according to the prominence attained by certain lesions, no distinct dividing lines can be drawn.

In the more acute cases the lesions are comparatively superficial. In such, to the naked eye, the stomach and upper portion of the small intestine may appear almost normal; toward the lower end of the ileum and throughout the colon, indications of inflammatory disturbance are to be seen; as a rule, they are specially pronounced in the region of the sigmoid flexure. The most important of these indications are irregular patches of local congestion, and more or less swelling with hyperæmia of the solitary glands and of Peyer's glands. Under the microscope hardened sections of the intestinal wall show, in places, loss of superficial epithelium. This is especially noticeable toward the lower portion of the ileum and over the whole of the colon, where a considerable infiltration of the mucosa with polynuclear leucocytes may frequently be seen. In some instances an invasion of the mucosa by bacteria takes place in areas where the epithelium is absent (Booker). These local conditions are by no means to be taken as a measure of the general systemic disturbance, for in a proportion of cases the manifestations of an acute general infection are pronounced; evidenced in the liver by fatty degeneration and sometimes necroses of liver-cells, in the kidney by necrosis of the epithelium in the convoluted and irregular tubules, and in the lungs by a lobular pneumonia.

In cases running a longer course the inflammatory changes may be more pronounced. In a proportion of these the lesions may be described as catarrhal in character. The macroscopic changes are to a great extent confined to the lower end of the ileum and to the colon, where the congestion is very pronounced, sometimes general, at other times localized in patches; the lymph-nodules are enlarged and can frequently be seen with commencing ulceration at their summit; Peyer's patches are also swelled and hyperæmic. Under the microscope hardened sections from stomach and small intestine reveal marked cloudiness of the epithelial cells and in places loss of superficial epithelium. The connective tissue of the villi and that supporting the glands of Lieberkühn is more or less densely infiltrated. The ducts contain an excess of goblet-cells and are distended with mucus. The loss of superficial epithelium is very general throughout the colon. Associated with it is a more or less dense infiltration of the mucosa, an infiltration which in places may extend even to the muscular coat. Should the case be more protracted, ulceration may supervene, chiefly in the colon, very rarely in the lower portion of the ileum. Such ulceration is, for the most part, superficial, rarely extending deeper than the mucosa. The ulcers, in general, are circular, but in the more severe cases several ulcers may coalesce, forming large, irregular patches, two to three inches in diameter (Holt).

In a larger group of cases the intensity of the inflammation appears to fall chiefly upon the lymph-nodules, which, throughout the colon and especially in the neighborhood of the sigmoid flexure,

show indications of a destructive inflammation. Under the microscope they are seen to be swelled and infiltrated, many showing focal necroses. The surrounding tissues are deeply infiltrated with lymphoid cells. If life be longer preserved the follicular tissues break down, forming small, but deep, ulcers, with overhanging edges, exhibiting a tendency to extend chiefly in the submucous tissue. These cases have very generally a fatal issue. In those cases in which such a termination is avoided convalescence is very slow, the diarrhœa assuming a chronic form, maintained by the presence of these ulcers, which, with difficulty, take on a healing action.

In a few—fortunately very rare—cases the inflammation is of such an intense fibrinous character as to lead to the formation of false membrane. This is the most severe form, and, although the pyrexia may be relatively moderate, the constitutional symptoms are very grave; death generally takes place in from eight to twelve days.

Diarrhœal Disorders.

Classification.—Attempts have been made at a classification of diarrhœal disorders, based either upon the changes found post-mortem in the intestinal canal or upon the bacteriological conditions met with in the discharges, but in both respects our knowledge is still too imperfect to permit us from it to draw dividing lines in a thoroughly satisfactory manner. As physicians we are able also to recognize clinically certain types of the disease, which to some extent correspond with the groups that pathologists have attempted. Nevertheless we, too, must admit that our clinical types have no sharp dividing lines, but, both in the group and in the individual patient, show a tendency to pass from the milder into the more severe form.

Two recent classifications, which rest partly on a pathological and partly upon a clinical basis, are worthy of mention. One is that of Lesage, who, in a very interesting article recently issued from the French press, groups the acute cases of infantile diarrhœa into three classes.

In the first he includes all those which are due to the presence in the infant's food, whether breast-milk or cows' milk, of irritant substances not the result of fermentation in the milk. These diarrhœas are generally of a mild type and quickly controlled. In a second group are placed those cases where the disturbance is due to fermentation in the stomach or intestinal canal of indigestible but, at the same time, more or less sterile food. The constitutional intoxication in these cases is due to the abnormal development of bacteria previously existing in the canal (endogenous). These cases, although sometimes severe, generally run a comparatively mild course. The third and largest group contains all those cases in which the diarrhœa is due to fermental changes in the milk administered as food to the infant. The poison-producing bacteria are thus introduced from without (exogenous). The constitutional symptoms met with in this class are frequently of the severest type.

This classification, although interesting, is scarcely as satisfactory as that made by Booker, who also groups the acute cases of diarrhœa met with during summer into three classes. In the first he places all cases of a dyspeptic and non-inflammatory character. In these the stools are lumpy and acid and contain no leucocytes or epithelial cells; the bacteria are only those of normal healthy motions; and the diarrhœa is of a milder form and for the most part easily controlled; but, if neglected, it shows a tendency to take on the characters of one

of the two succeeding classes. The second group is characterized by symptoms of only moderate inflammation, but there is present a well-marked toxic condition of the system; the stools are numerous, of a watery or pasty character, and contain few, if any, leucocytes, but bacilli in distinctly predominating numbers; seldom, however, is any one variety so greatly in excess as to exclude the influence of other forms. In the third group of cases we meet with a distinctly inflammatory diarrhœa associated with symptoms of a general infection; the stools are frequent and slimy and contain many leucocytes; streptococci are found in predominating numbers, although other forms of bacteria are also present. In the more severe cases an invasion of the tissues of the intestinal wall by the streptococci takes place, and in many instances more or less extensive ulceration of a suppurative character may be found post-mortem. There is, according to Booker, a considerable difference in the clinical course run by the individual cases in this group; some patients respond readily to treatment, while others are little influenced and steadily grow worse, until the disease terminates fatally. Booker thinks that this may possibly be due to the fact that the streptococci met with are of more than one variety.

Of this classification, Booker says that in typical instances the three forms may be easily recognized, but there are many transitional cases which do not fall into any one of the three groups and are probably due to a more mixed infection in which no one bacterium is especially predominant. This classification of Booker's corresponds clinically very closely with that of Holt, who, however, lays more emphasis on the anatomical post-mortem changes.

To these groups we must add a fourth, comprising those cases which assume a chronic type, and are not infrequently met with as the sequelæ of one of the preceding forms. With this group, as with the others, we can draw no definite dividing-line separating it sharply from the more acute cases. Holt terms those cases chronic which have persisted longer than six weeks. Some cases, however, assume the type of chronicity sooner, even, than this. In them the signs of active inflammation subside, the appetite partially returns; the diarrhœa, though lessened, still persists and is associated in some instances with a varying amount of ulceration of the intestinal wall, in others with a more or less atrophic condition of the intestinal glands. In the latter variety the progressive emaciation indicates how serious is the interference with the processes of digestion and absorption.

These somewhat provisional groups may be tabulated as follows:—

1. Functional diarrhœas, non-inflammatory in character.

2. Inflammatory diarrhœas, in which the symptoms of a toxic systemic infection are predominant.

3. Inflammatory diarrhœas, in which in addition to the systemic infection the symptoms of an acute local inflammation have a prominent part.

4. Chronic diarrhœas, in which the acute inflammatory symptoms have more or less subsided, but in which the stools remain abnormal both in character and frequency, and emaciation is apt to supervene.

Functional Diarrhœas.—Many cases of infantile diarrhœa are met with which cannot be otherwise regarded than as purely functional in character. During dentition a moderate increase in peristalsis and secretion is sometimes noted which it is difficult to attribute to any

fault in diet, and which promptly subsides on the eruption of the teeth. In a few instances a similar condition may be induced by impulses acting through the nervous system, such as fright, over-excitement, and a sudden chill to the surface of the body. At other times these same causes appear to produce their effect chiefly by disturbing digestion. Substances also may occasionally be given as food to the infant which act as direct mechanical irritants to the sensitive mucous membrane of the alimentary tract.

In this group are also to be placed many diarrhœas met with in breast-fed infants, where, owing to a faulty dietary or mode of life, or to nervous overstrain on the part of the mother or nurse, the breast-milk becomes altered, resulting in either gastric or intestinal indigestion followed by diarrhœa. The time of weaning is similarly one of peculiar susceptibility. Infants artificially fed suffer sometimes from this form of the disease; in them any error in the preparation or administration of their food may be followed by an attack of diarrhœa. In such, however, these attacks are more liable than in the breast-fed to assume an inflammatory type. This liability is still further increased by all conditions lowering the digestive powers.

Symptoms.—In some instances the diarrhœa may commence quite suddenly with large more or less fluid motions, containing, besides fæcal matter, considerable undigested material. In other cases symptoms of gastric irritation and abdominal pain precede for some hours the diarrhœa. Examination of the infant generally reveals a moderate amount of pyrexia: 100° to 102° F.; rarely does the temperature run higher except in cases of sudden onset with severe gastric disturbance. Slight abdominal distension may often be noted. The stools are frequent, thin, usually sour-smelling, and of varying color. In young infants on an exclusive milk diet, they are, in general, of some shade of green and of a distinctly acid reaction; occasionally, however, they are gray or chalky in color and frothy in character. In older infants, on a more mixed diet, the stools may have no uniform color, but be in part green and in part some shade of brown, and of a very unpleasant odor. Examination under the microscope reveals, besides undigested material, only those forms of bacteria met with in normal fæces. The infant is peevish and may either refuse its food altogether or drink a part greedily to allay its feverish thirst, and then refuse the remainder. Should the pyrexia run high, nervous symptoms may manifest themselves in twitching of the limbs, prostration, and wakefulness.

The attack in this type of the disease is of brief duration. After the diarrhœa has continued for some hours the temperature generally falls; nervous symptoms, if present, pass away; the motions in a few days become less frequent and gradually resume their normal appearance; and the desire for food becomes more imperative.

Diagnosis.—At the onset, unless from the history of the case, it is impossible to predict with certainty just what we may have to deal with. It must be remembered that symptoms similar to the above may not infrequently usher in a severe constitutional disorder.

Prognosis.—Simple functional diarrhœa, unless in infants of the weakest constitution, can never be regarded as presenting much cause for anxiety. The danger lies in neglect. An injudicious dietary, especially in hot weather, may prolong the attack or convert it into one of the inflammatory forms of the disease.

Treatment.—In cases where the diarrhœa appears to have removed the irritant it will suffice to secure absolute rest to the alimentary tract for a period varying from twelve to twenty-four hours, permitting only sterile water in small quantities as frequently as may be desired. If the attack has been of a mild character, a thin rice- or barley- water containing a small amount of sugar of milk may be allowed after the first twelve hours have passed. Stimulants in the form of whisky or brandy are to be given only if any indications of prostration make their appearance. In the majority of cases this dietary may be increased after twenty-four hours. In infants who are breast-fed nursing may be allowed once every four or six hours, permitting the infant to take a little more than half its usual quantity at each nursing. Rice-water or weak albumin-water may be given between-times. In those artificially fed the food for several days must be weak in character, and limited in amount. A small quantity of a creamy milk may be added to the rice- or barley-water.

The foods of greatest value in the treatment of summer complaint, and the indications for their use, considered by the writer to be as follow:—

"Whisky, one of the most useful, never contra-indicated; especially useful in acute cases during the last twenty-four hours of treatment, but may be given at any time in either acute or chronic cases.

"Meat-broths contain so little albumin and carbohydrates that they are never theoretically contra-indicated. They may be given at any time, in either acute or chronic cases, but they are especially indicated in acute cases after the first twelve or twenty-four hours' treatment.

"Cream contains so little albumin that theoretically it is never contra-indicated. It can do no harm in any form of the disease, but it will be found to serve the best purpose in chronic cases, and after the third or fourth day in acute cases.

"Barley-water and oatmeal-water may be mixed with milk to advantage, as they mechanically facilitate the digestion of casein. In this combination they may be useful in chronic cases and in convalescent acute cases.

"White of egg is contra-indicated in all cases of summer complaint when there are marked constitutional symptoms present, or when the diarrhœa is putrid or mucous, but it may be used in that form of the disease dependent on an abnormal acid fermentation. Rachford (Archives of Ped., No. 6, '92).

In cases of diarrhœa beginning with very active symptoms, all food to be withheld for twelve or twenty-four hours. Water may be given, or water and brandy, or perhaps a little chicken-broth. When there is vomiting everything should be given cold. When milk can be retained by the stomach, it is to be preferred to other food, but must be given very largely diluted. Combe (Revue Méd. de la Suisse Rom., Jan. 20, '90).

Special attention drawn to the fact of great loss of water which these patients sustain. The writer allows water freely, or chamomile-tea, or fennel-tea, and also uses baths. As soon as feeding is begun at all, milk is to be used at first in the dilution of 1 part to 9 parts of water, gradually increasing the proportion of milk to one-quarter or even one-third. Meinert (Inter. klin. Rund., Sept. 28. '90).

Infants suffering from diarrhœa treated by withholding the milk by which they are being fed and giving them water only. Lutori (Med. Press and Circular, Apr. 5, '93).

Slightly alkaline and aërated water in small doses, often repeated, administered, all food being suppressed from ten to eighteen hours, according to the condition of the infant. It is very essential to exercise great circumspection in ordering the return to the ordinary diet. If the child is collapsed when first seen, subcutaneous injections of water must be resorted to. As soon as tolerated, the child is to receive a mixture of four-fifths water and one-fifth sterilized milk, cold

bouillon, and albuminosed water. Rémy (Gaz. Méd. de Strasbourg, July 1, '93).

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Treatment of infantile diarrhœa by a regimen of boiled water, cooled to a suitable temperature, and given in small quantities every hour or half-hour, or as thirst demands, to the exclusion of all food for eight, twelve, or even twenty-four hours, advocated. Watu (Charlotte Med. Jour., Aug., '97).

In an acute attack of summer diarrhœa in a child under two years of age all albuminous and starchy foods should be withheld at once. Instead, toast-water—made by laying in a large bowl two pieces of stale white bread toasted brown on both sides, pouring on boiling water till covered, and adding a pinch of salt and allowing to stand till cool, the clear water being then poured off into a fruit-jar and kept cool by ice—is excellent. Barley-water, made by boiling a handful of pearl barley in a pint of water for one hour or more, a pinch of salt being added, can also be prepared, and after it is cool the supernatant liquid can be poured off for use. From one to three tablespoonfuls of either of these foods can be given every hour or two for forty-eight hours if necessary. Alcoholic stimulants may be added if necessary. These drinks should always be given cold. When the vomiting and stools have improved, which usually occurs within forty-eight hours, nursing may be resumed at intervals of either two, three, or four hours. If sterilized milk be used it should not be for longer than the summer months, on account of the tendency to produce rachitis. A mixture of cows' milk, diluted one-fourth with water and containing a little milk-sugar and a pinch of salt, is to be preferred. The prepared milk is placed into a double-boiler of agateware, and the water in the outer vessel is allowed to boil for fifteen minutes. The inner vessel is then rapidly cooled, and the contents poured into a well-scalded tight fruit-jar, and kept by the ice until required for use. The entire quantity required for use during the day can thus be prepared at once. After each feeding the child's mouth should be wiped out with a bit of absorbent cotton soaked in a saturated solution of boric acid. Plenty of water that has been boiled and cooled should be given. Dessau (Clin. Recorder, '97).

In the majority of instances, however, it is wiser to secure at the outset by means of medicine a thorough evacuation of the bowels, ridding them in this way of any fermenting material. To accomplish this we may make use of either castor-oil or calomel, both of which act promptly and with little irritant effect on the mucous membrane. Of the former a full dose may be given in any convenient way. Should there be much gastric irritation, as shown by a tendency to retch or vomit, the latter is preferable, and may be given in small doses—$^1/_8$ to $^1/_4$ grain, at short intervals—until a decided effect is obtained. Afterward, if necessary, one of the preparations of bismuth may be given with each feeding, for a few days.

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Slight purge should be given to begin with. If this fails, enemata of starch-water with from half a drop to a drop of laudanum may be administered, and repeated two or three times a day if necessary. Internally, bismuth or astringents are to be used. M. A. F. Plicque (Pract., Oct., '96).

In simple diarrhœa the indications are to first remove by purgatives the irritating and decomposing contents of the intestines. This is best done by giving calomel in small doses—say, $^1/_{10}$ grain—frequently repeated or by a full dose of castor-oil.

The second indication is to withhold food which would be likely to undergo fermentation and add to the existing toxæmia. Milk and other foods should be absolutely prohibited. The child should be allowed to take pure water quite freely. Barley-water, to which a little white of egg or sugar has been

added, may be given, and, later, whey may also be given.

Third. If ptomaines are thought to be present in the lower bowel it would be well to irrigate after each movement of the bowels, using a warm normal salt solution (1 drachm to 1 quart), about 1 pint at a time.

Finally, such drugs as retard fermentation: *e.g.*, bismuth subnit., gr. x, every two or three hours; or soda benzoate in 4-grain doses in water every two hours. J. Lewis Smith (Pediatrics, July, '96).

Salicylate of bismuth given in fifty cases of diarrhœa in infants under two years of age, with only two deaths. The following formula is recommended:—

℞ Bismuthi salicylici, 24 grains.
Gummi arabici, 1 drachm.
Sacch. albi, 1 ½ drachms.
Terendo adde aq. dest., 2 ounces.
Fiat lac, tum adde aq. dest., 4 ounces.

M. D. S.: The bottle to be kept in cold water or ice, and to be shaken well before use. One or two teaspoonfuls three to six times daily. In cases of offensive diarrhœa the administration should be preceded by a dose of castor-oil. In acute cases the remedy is useless, but in all of a week's standing or longer its effects are excellent. Mikhnevitch (Med. Oboz.; Indian Lancet, Aug. 1, '97).

Inflammatory Diarrhœas.—The two groups of inflammatory diarrhœas include almost all the cases of infantile diarrhœa met with during the summer months. They are very closely allied in their etiology, and although the intestinal lesions in the one are comparatively slight, while the symptoms of local inflammation in the other become prominent, in both we have to deal with marked constitutional disturbance. All that we have said in reference to the influence of age, of season, and of mode of feeding is equally true of both groups. The symptoms and course of these two varieties of the disease differ in important particulars. We have already referred to their pathology; we cannot but feel, however, that there is still much that is obscure, and later investigations may prove the bacteriological relations of the two classes are even closer than at the present they appear.

Inflammatory Diarrhœas in which the Symptoms of a Toxic Systemic Infection are Predominant—Acute Gastro-Enteric Infection — Acute Gastro-Intestinal Catarrh.

Symptoms.—As we might be led to almost expect, when we consider the various ways and the varying numbers and characters in which these toxin-producing bacteria make their entrance into the alimentary tract and the varying conditions under which their development may take place in the stomach and intestines, the mode of onset of this disease is very variable. Frequently it is gradual; the symptoms may present little except their persistence to distinguish them from those produced by indigestion. The infant may be fretful, show occasional signs of colic, be restless at night, and slightly feverish; and associated with these disturbances may be some looseness of the bowels. As the disease progresses the symptoms increase in severity; the motions become frequent, thin in character, and of a varying color, and of a sour, or more generally of an offensive odor; pyrexia increases; the pulse becomes quick and weak; and pain becomes a marked feature, interfering with rest and sleep. At other times the onset is sudden, frequently with severe gastric disturbance, high fever, and sometimes alarming nervous symptoms. In these cases vomiting is one of the earliest symptoms, and may continue in the most persistent manner; the temperature may be very high, 104° to 105°, but generally falls one or two degrees after diarrhœa sets in; twitching of the

limbs, great restlessness, and sometimes delirium, or even convulsions, may usher in the attack. When the disease is well established, the symptoms become very characteristic; the infant is restless, crying frequently; the face is pale and its features somewhat pinched; the eyes sunken; the tongue coated in the centre, but with tip and edges red and dry; thirst is pronounced, but fluids are frequently vomited shortly after they are taken; the abdomen is generally, but not always, distended. Often we may distinguish through the thin abdominal wall special dilatation of the stomach or small or large bowel; the skin gradually assumes a dry harsh feeling, while the subcutaneous tissues waste rapidly; the temperature varies from 102° F. in the morning to 103° F. or more in the evening, and the quick and feeble pulse indicates great exhaustion.

While the stools may at first contain some undigested matter, this soon in great part ceases, and they become of a greenish, greenish-yellow, or brown color, and of an offensive odor, and are associated with a large amount of flatus. Little useful diagnostic information can be gained from their appearance, but we may generally consider that frequent and watery stools indicate a severe attack. The reaction is in the beginning always acid, but in the more severe cases becomes neutral or even alkaline. Lesage says that a relation generally exists between the character of the reaction and the degree of infection. Under the microscope the stools are seen to contain undigested food, epithelial cells, few if any leucocytes, and numerous bacteria, among which bacilli predominate. Vomiting at the first may be violent and persistent, but, as the case progresses, the tendency for it is to subside. Pain to a greater or less extent is always present. In the earlier days it is a prominent feature; while later on, perhaps owing to general exhaustion, the infant appears to suffer less acutely. Exacerbations may be noticed shortly before each evacuation. The presence of abdominal tenderness is generally a difficult matter to ascertain.

With these local symptoms the indications of a toxic infection of the system are not wanting; the temperature remains moderately high, 101° to 103° F., with a tendency to rise in the evening and fall again toward morning; the pulse is quick, and may become weak and intermittent; emaciation goes on rapidly; with a greatly increased loss of fluid in the alvine evacuations, the urine becomes scanty and high-colored, and contains a large amount of indican. As the disease progresses to an unfavorable termination, the general prostration increases, the extremities become cold, slightly cyanosed, and sometimes œdematous, and the slightly-swelled eyelids only half-close over the deep-sunken eyes; the fontanelle, if still open, is much depressed; the infant ceases to cry, and death closes the scene generally in a very quiet manner.

Complications.—In the more severe cases complications are frequently met with. In a large proportion more or less bronchial catarrh is present by the end of the first week. Fenwick states that in 87 per cent. of his cases signs of bronchitis were present at the end of the fourth day, and lobular consolidation was encountered in nearly 37 per cent. of his entire number. The onset of broncho-pneumonia is often very insidious; the cough may be only slight, but the respirations will be observed to be unduly frequent, and the temperature shows a distinct rise. The physical signs are generally obscure, and most fre-

quently are localized at the base of the lungs.

Percussion may show only a slight deficiency in resonance, and on auscultation we may find either a diminution of vesicular murmur or the presence of sibilant râles. It is characteristic, however, of this form of infection that these signs are variable, and show a tendency to change from one place to another; it is exceptional to observe large areas of consolidation. The progress of the pulmonary lesion is modified by the general symptoms of the case; increased dyspnœa is always a symptom of grave import.

Pleurisy is very seldom observed; when it does manifest itself, it tends rapidly to become purulent. Associated sometimes with the pulmonary infection, but occasionally as a complication by itself, we meet with symptoms of cerebral congestion, manifested in stupor, delirium, or epileptiform convulsions. Only rarely do we observe definite signs of local trouble; such as strabismus, inequality of pupils, and irregular pulse and respiration. Lesage makes reference to some forms of paralysis which disappear with returning health. Thrombosis of the cerebral vessels may take place in the final stages, and may, or may not manifest its presence by special symptoms. Occasionally an attack of tetany may supervene. Should the drain of fluid from the tissues have been great, the defective circulation may in itself give rise to many of the above symptoms. Infrequently the cerebral symptoms may be regarded as of a uræmic nature.

A true parenchymatous nephritis due to infection would appear to be a rare complication. Kjellberg states he met with it in 47 per cent. of his fatal cases; but competent observers, both English and American, have failed to meet with it, except very occasionally. Fenwick states that albumin in the urine was noted in 17 per cent. of his cases before the fifth day of the disease; but in no instance did the urine show more than a trace of it. Under the microscope he never observed either blood-corpuscles or epithelial casts. Booker states that necrosis of the epithelium in the convoluted and irregular tubules was found in nearly all his cases, and, in not a few, hyaline tube-casts were demonstrable. Infiltration with leucocytes was not seen in any case.

Various rashes on the skin may occasionally be noted, usually of an erythematous nature; and, unless great care is exercised, a mycotic ulceration of the mouth and throat may add greatly to the infant's discomfort.

Diagnosis.—While there may be for the first two or three days some uncertainty in reference to the character of a diarrhœa, a persistent high temperature beyond this period stamps the attack as of an inflammatory nature. After this date fluid evacuations of an offensive odor are characteristic of the toxic form; while small stools containing mucus in quantity and passed with much straining are met with in those cases in which the local inflammatory disorder is prominent. Typhoid fever is seldom met with during infancy; its onset is occasionally somewhat abrupt, but after the first few days its course becomes more characteristic. Widal's test should be applied in doubtful cases. Several of the acute specific fevers are sometimes ushered in by an intestinal disturbance, which may for two or three days be misleading; of these scarlet fever and pneumonia are probably the most important. Intussusception develops rapidly and the stools always contain mucus and a considerable amount of dark blood, and are passed

with straining; for the first few days there is no pyrexia.

Prognosis.—In every attack of inflammatory diarrhœa the prognosis must be greatly dependent upon our securing from the outset fair hygienic conditions, and the strict observance of such dietetic rules as may be laid down. In no disease is the prognosis more affected by a faulty hygiene or by an imprudent dietary. In infants suffering from chronic dyspeptic troubles, or in those whose nutrition is seriously impaired, the prognosis must always be grave. During the heat of summer an attack of inflammatory diarrhœa is of much more serious import than one occurring during the cooler months of the year. In the course of an attack a decrease in the temperature and in the frequency of the stools are favorable symptoms, especially when associated with an improvement in the general appearance, an increase in the amount of urine, and perhaps an increased desire for food. On the other hand, a higher temperature, more frequent and more watery movements, a more anxious expression on the features, increasing insensibility of the pupils, sighing and irregular respiration, a feeble and intermittent pulse, suppression of the urine, and the onset of nervous symptoms must all be regarded as of grave significance.

Treatment.—Regarding this disorder as due to an intoxication of the system, either induced suddenly by an absorption from the intestinal tract of toxins in large amount, or coming on gradually, owing to the development in the intestinal canal of pathogenic bacteria with a subsequent absorption of toxins, our first efforts should be directed to securing as promptly and as effectually as possible the clearing out of the intestinal tract. This we endeavor to effect by means of promptly acting purgatives, and by lavage of the stomach and large intestines; the small intestines, unless by means of purgatives, we are apparently unable to reach.

At the same time we endeavor to limit the development of bacteria by stopping for several days absolutely all milk food, in which we know they are able to develop very rapidly; a sterile water only should be allowed as a drink for the first twenty-four hours. During the early days no astringent or drug which would tend to check peristalsis, at this period to be regarded as salutary in character, is to be given. For the evacuation of the intestinal tract two drugs especially commend themselves, on account of their promptness and of the very slight amount of irritation which they induce. These are castor-oil and calomel.

Castor-oil is of much value if it can be retained in the stomach. A full dose, 1 or 2 drachms, may be given in any convenient way. In many cases there is too great irritability of the stomach for us to attempt the administration of this somewhat nauseous drug, and we can with advantage have recourse to calomel, which acts not only as a purgative, but also as an intestinal antiseptic. This drug may be given either in one full purgative dose, or in a series of small doses repeated at short intervals. Lesage recommends that if the onset is with high fever, a foul-smelling but not abundant diarrhœa, and a considerable amount of tympanites, a dose of about 1 grain, for an infant of three months, 2 grains for an infant under one year, and 3 grains for an infant over that age, should be administered, mixed with a little sugar in a powder. In those cases where the fever is only moderate, where the abdomen is soft and not distended, and the diarrhœa is copious, small doses

of about $^1/_5$ grain may be given every one or two hours, for six or twelve doses. Other purgatives have been employed, but, in our opinion, they are not so satisfactory.

Beneficial results obtained with the biniodide in $^1/_{50}$-grain doses, usually in a solution of iodide of potassium. Of eighty cases of acute infantile diarrhœa treated by this method, in 72 the diarrhœa was cured in two days. Luff (Brit. Med. Jour., Nov. 16, '88).

[Great benefit obtained from use of biniodide of mercury, particularly in the green diarrhœa of infants. C. R. Illingworth, Collaborator, Annual, '90.]

Should vomiting persist, a careful lavage of the stomach will often at this period of the disease prove of much value, not only removing fermenting material and toxins, but having a direct action on the gastric mucous membrane. This lavage can easily be accomplished by means of a few feet of rubber tubing, to which is attached at one end a soft-rubber catheter, number 15 or 18 English (No. 30 Charrière), and to the other a small glass funnel. The fluid used may be either sterile water or normal saline solution, 7 per 1000. Its temperature should be about 100° F.

Three or 4 ounces should be introduced at a time and allowed to escape. This should be repeated until the water returns clear.

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Water is one of the poorest media for the development of bacteria which it is safe to introduce into the stomach. If a child is given from 10 to 12 ounces of sterilized water daily vomiting will cease at once, diarrhœa will soon disappear, and the temperature will fall so that in a relatively short time milk can again be given. Absolutely no medicine will be required. Most brilliant results obtained from this simple treatment of infantile diarrhœa. Mongour (Corres. f. Schweizer Aerzte, Apr., '98).

Occasionally one of the milder antiseptics is added to the solution; we are convinced, however, that using them in this way, either for lavage of the stomach or lavage of the intestines, the risk of absorption of an overdose more than counterbalances any possible advantage.

Thirteen cases of diarrhœa with gastric disturbances treated by stomach-washing, 8 of which were cured without the use of drugs. Darrell (North Carolina Med. Jour., Aug., '91).

A few hours after the administration of the purgative, an effort should be made to wash out the colon. The infant at the first should be placed on its back with its hips well elevated, and a normal saline solution at a temperature of 98° F. be allowed to flow slowly into the intestines through a large-sized rubber catheter introduced for six or eight inches. The pressure in the tube should be slight, the reservoir not being higher than twelve inches above the hips of the patient. If the hips are sufficiently elevated a little gentle massage over the region of the sigmoid flexure secures the free passage of the fluid into the descending colon, and afterward, turning the infant on its right side, favors its entrance into the transverse and ascending colon. Should there be much pyrexia after the current has been once established, the temperature of the water may be lowered 10° or 15°. Lower than this has been recommended by some physicians, but the very interesting experiments of Dr. R. Coleman Kemp warn us that we may in this way produce too much depression. The injection should be continued until the water returns clear. If done carefully, the pulse after the injection should evidence more strength, the blood-pressure should be raised, not depressed. Afterward a cool or warm compress—70° to 100° F.—applied over the abdomen

and covered with oiled silk and a flannel binder soothes and assuages the pain. This lavage of the intestines may be repeated every six or twelve hours for the first two or three days; afterward less frequently.

The following treatment has proved most successful:—

The stomach and bowels should be freed of all food, mucus, etc., by lavage, introducing an ordinary catheter (soft, flexible, No. 10) attached to a fountain-syringe, and using about 1 quart of lukewarm water in which is dissolved 1 teaspoonful of boric acid or salt,—sodium chloride. In irrigating the bowel it is a good plan to use Tiemann's rectal tube, introducing it, with a little vaselin, into the rectum, and gently pressing it upward through the internal sphincter. The intestines are irrigated with the solutions mentioned above, until the discharges from the bowels are clear. This mechanical treatment is then followed by salicylate of bismuth, 3 to 10 grains every two or three hours.

If the child is over six months old, it is wise in all diarrhœas to discontinue the breast and give the child barley- or rice- gruel. Raw scraped steak and beef-blood are recommended. Louis Fischer (The Post-graduate, Sept., '92).

Fifty children under two years of age have been treated, at the New York Dispensary, by irrigation of the colon and regulation of the diet, without medicine. These fifty have not been picked cases.

The majority (66 per cent.) were relieved by one irrigation; some received two and a few three irrigations. A small proportion (20 per cent.) received additional treatment. One case died on the third day after being so treated. Huddleston (Med. Rec., Sept. 9, '93).

Fifty children under two years of age treated by irrigation of the colon and regulation of the diet, without medicine. Sixty-six per cent. were relieved by one irrigation; some received two and a few three irrigations. Twenty per cent. received additional treatment. Two quarts of 6-per-cent. salt solution are used at a temperature of 68° to 75° F. (20° to 23.9° C.). A No. 12 catheter is passed as far as possible into the colon. Huddleston (Med. Rec., Sept. 9, '93).

Most desirable position for injection is the dorsal, with the thighs flexed and the pelvis elevated and a pressure of not more than one to one and one-half metres. In 200 patients experimented upon ileocæcal valve offered effectual resistance in only 27. Sokolow (Amer. Jour. Med. Sci., Apr., '95).

Intestinal lavage with warm, boiled water, Vichy water being added. Infant lying on the side, first the right, then the left; tube inserted 15 centimetres and water slowly introduced. If discharges fœtid, calomel; also 1 drop of laudanum every hour. If obstinate, vomiting, lavage of stomach and egg-albumin in water given. Grancher (Revue Gén. de Clin. et de Ther. Jour. des Prat., May 18, '95).

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In infectious diarrhœa in infants, the food-supply is to be stopped, the products of imperfect digestion removed from the intestinal tract by irrigation, continued until the water returns free from admixture of fæcal matter. A solution of 20 grains of tannic acid in a pint or more of sterilized water injected and retained in the bowel abont an hour. When vomiting persists the stomach should be washed out also. To neutralize the toxins calomel in $^1/_{10}$-grain doses hourly for the first twenty-four hours is recommended. First among antipyretics is the cooled bath. When watery discharges continue after the irrigation, hypodermics of $^1/_{100}$ grain of morphine and $^1/_{800}$ grain of atropine can be given. Stimulants are indicated in the severe cases, and whisky is the best that can be given. After the urgent symptoms have subsided the child can be nourished with the white of an egg stirred in cold water or the mixture recommended by Jacobi: 5 ounces of barley-water, the white of 1 egg, 1 or 2 teaspoonfuls of brandy or whisky, some salt, and sugar. A teaspoonful every five or ten minutes is indicated. No milk should be given for several days. H. M. McClanahan (Amer. Jour. Obstet. and Dis. Women and Children; Med. Rec., Sept. 26, '96).

Many physicians at this period advocate strongly the administration of some drug which may act as an intestinal antiseptic. Among the more important of these drugs we may mention resorcin, menthol, thymol, bismuth salicylate, sodium salicylate, benzol-naphthol, and others.

It is not to be forgotten, however, that many of these drugs are very distinct cardiac depressants, and we are convinced that we have seen many instances in which they have been employed with too much freedom, to the disadvantage of the patient; at the same time it is questionable of how much practical value they are. Under this treatment the pyrexia will be found to slowly subside, and the frequency and character of the stools to alter for the better. At this stage some of the milder astringents may be of service. Among the most frequently employed are the salts of bismuth: the subnitrate, the salicylate, and the subgallate. These may be given in full doses, suspended in mucilage with some aromatic water. Tannigen, a new astringent, having also distinct antiseptic properties, may, after all the inflammatory symptoms have subsided, be of service. It may be given in a powder, combined with a little sugar, in doses of from 4 to 6 grains.

The disorder always commences in the stomach, and is most easily controlled by carbolic acid. But its hot taste and unpleasant smell, as well as the occasional occurrence of carboluria, rendered its use unpleasant. Resorcin is extremely palatable to children; and is devoid of toxic properties when given in doses from 1 to 5 grains. Three grains given every four hours to infants only a few weeks old without the least ill-effects.

In a hundred and twenty cases of intestinal dyspepsia in infants and young children this treatment was used with the following results: In 53 per cent. the disorder had lasted from one to two weeks, in 34 per cent. from two to four weeks, in 10 per cent. from four to eight weeks, and in the remaining 3 per cent. for a period of more than two months. Out of the entire number in only nine instances did the diarrhœa continue after the treatment had been pursued for a week, the majority ceasing within three days. W. Soltau Fenwick (Brit. Med. Jour., Dec. 21, '95).

For diarrhœa with offensive stools $^1/_2$ drop of creasote in chloroform-water every hour or two has been most satisfactory. Butterfield (Med. World, June, '90).

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In diarrhœa associated with very fœtid motions the greatest benefit seen to follow the administration of creasote. W. H. Dickinson (Lancet, Mar. 28, '96).

Tannigen followed by excellent results in the diarrhœa of children especially in the catarrhal variety. It passes through the mouth and stomach as an insoluble powder. It is dissolved in the intestinal canal at all places where an alkaline reaction prevails and exerts its astringent effect.

To obtain positive results tannigen must be prescribed in large doses, 4 grains to infant up to one and one-half years, and $7\,^1/_2$ grains to older children, four to six times daily. Escherich (Therap. Woch., Mar. 9, '96).

Tannigen successfully employed in twenty-eight cases of diarrhœa. Sixteen of the patients had acute gastro-enteritis, and eleven chronic diarrhœa. In all of the acute cases but one the remedy acted promptly. In the cases of chronic diarrhœa, all of which were under one year of age, tannigen gave excellent results. Diarrhœa, of several months' duration, which had resisted other remedies, yielded with wonderful rapidity. Strauss (Berl. klin. Woch., No. 3, '96).

Chronic Diarrhœa.

Etiology.—The chronic form of diarrhœa is met with either as the result of a previous acute attack or arising in an in-

sidious manner from prolonged irritation of the intestinal canal by ill-digested and more or less fermenting food.

In the majority of those cases in which it follows an acute attack we have to deal with more or less definite organic lesions present in the alimentary tract. In some the persistent diarrhœa is due to ulceration of the intestinal wall, generally follicular, but occasionally catarrhal, in character. In others a more or less atrophic condition of the tubular glands and villi in the small intestines, associated with marked cell-proliferation in the adenoid tissue of the mucosa (Holt), is present. In a few instances the constitution of the infant has been so profoundly impaired during the acute attack that the various systemic functions are re-established with difficulty. Digestion continues to be imperfectly performed; and fermentation with development of toxins takes place to an irregular extent. This slight, but continued, systemic intoxication manifests itself in anæmia, defective general nutrition, and an irritable nervous system.

Symptoms.—The cases of chronic diarrhœa form a considerable proportion of the diarrhœas met with during the autumn. In such, the symptoms of acute inflammation have to a great extent subsided; the temperature remains for the greater portion of the day normal, and sometimes falls even below the normal line; and pain and tenderness have almost entirely passed away; but the motions still remain too frequent; their odor is offensive; blood is occasionally seen in the form of minute dark specks; and mucus of a greenish or brownish color is still present in considerable amount. The consistence and color of the stools is variable. At one time they are of nearly normal consistence and fairly homogeneous; at other times they are quite fluid. They are usually associated with much flatulence. Prolapse of the bowel occurs only occasionally.

The infant's appetite appears very variable, but a fair amount of nourishment is generally taken during the twenty-four hours. Vomiting is infrequent. Nevertheless the infant remains pale and weak, and lies in a helpless and apathetic manner. As the disease progresses nutrition steadily fails. The infant ceases to grow. A gradual loss in weight occurs through wasting of the subcutaneous tissues till the inelastic skin hangs in folds over the shrunken limbs. In many cases the abdomen may be somewhat distended, but in others it is soft and retracted. The liver and spleen are found of normal size. The mesenteric glands, although in post-mortem examinations they are seen to be enlarged, are not palpable. Occasionally petechial spots are seen either on the abdominal wall or on the extremities. The circulation in these infants is very feeble. The extremities are always cold, sometimes cyanotic, and occasionally œdematous. The urine is scanty. The nervous system suffers with the general failure in nutrition. The infant is peevish, easily disturbed, and sleeps badly at night.

The progress of these cases is by no means uniform. Some weeks may show a slight gain; but trivial causes, a chill to the surface of the body, or a slight irregularity in feeding, may bring on a relapse, and the gain is usually soon lost.

Complications frequently arise. Bronchitic or pneumonic symptoms may appear in the lungs. Rachitis frequently develops. Sometimes we have a general adenitis, or a still more distressing furunculosis. Only very rarely is nephritis encountered.

A fatal termination is frequently hastened by some intercurrent disease; at

other times it advances very slowly and the ending comes so gently that the exact moment of death is unascertainable. In a few cases, however, the appetite gradually returns, the stools become more normal, nutrition gradually improves, and at last convalescence is thoroughly established.

In the second class of cases this chronic form of diarrhœa establishes itself without any preceding acute attack. Eustace Smith considers that in the majority of these cases the affection is due to repeated chillings of the surface of the body, producing a catarrhal condition of the gastro-intestinal tract. Another important factor is undoubtedly a more or less faulty dietary, associated with the depressing influence of unhygienic surroundings. It is a form of diarrhœa frequently met with in young infants under four months reared in hospitals or foundling institutions.

The onset of the attack is gradual and insidious. A failure to gain in weight, or an actual loss, may be the first symptom demanding attention. On inquiry the infant will be found to pass several pale, pasty evacuations during the day, which on examination will be found to consist in great measure of undigested food. In spite of ordinary therapeutic measures this condition is apt to persist. Some weeks a slight improvement may be noted, but occasional exacerbations of the diarrhœa with fever soon dissipate any gain that may have been made. As the disease progresses, the stools change in character and become more frequent; at times they may be frothy and sour-smelling; at other times thin, dark-colored and offensive; their character is very variable. The abdomen is generally more or less distended. Cool perspirations occur when the infant falls asleep. The urine becomes scanty and contains both indican and urobilin. Nutrition fails. The skin assumes an earthy hue, and the face acquires a curious look of old age. The infant lies in its cot in a helpless, apathetic state, and makes its wants known by a scarcely audible whine. Such infants readily succumb to some intercurrent disease. Any of the complications which we have already referred to in connection with the preceding groups may be met with in this condition; the mortality is very great. Medicines appear of no avail. A complete change of air, to the sea-side or a bracing country- or mountain- air, appears to be the only remedial measure to any extent effectual.

Diagnosis.—An exact diagnosis in these cases is often difficult. The question arises as to whether the condition present in the intestine is a sufficient explanation in itself of the serious failure in general nutrition, or whether we have in addition to deal with some underlying constitutional disease,—such as tuberculosis, a disease which not infrequently manifests itself as a sequel after severe or prolonged diarrhœal attacks. The question will always be a difficult one, but the physician will act wisely if he base his opinion rather upon the history of the case and the general condition of the patient than upon any one particular symptom or physical sign.

Prognosis.—The prognosis in cases of chronic diarrhœa must always be very guarded. To some extent it is dependent on the previous constitution of the infant, on the hygienic conditions obtainable, and upon the zeal and regularity with which all instructions are carried out. To a great extent it is also dependent upon the severity and extent of the intestinal lesions. When ulceration, either catarrhal or follicular, is present to any considerable degree, the prognosis is always bad, though perhaps, under

favorable conditions, not hopeless. In those cases, on the other hand, where mere catarrhal or follicular inflammation without ulceration is present the prognosis is distinctly better. With favoring circumstances we may hope that a large proportion of these will proceed to complete recovery. To distinguish accurately between these two classes by the symptoms or physical signs existing at the time of examination is impossible. Our chief dependence must be placed on the previous history of the case. The longer the inflammation has lasted, and the higher has been the temperature, the greater the probability of ulcerative lesions. (Holt.)

Treatment.—With the conditions present in chronic diarrhœa no good, but often harm, may result from the employment of ordinary astringent, or even antiseptic, remedies administered by the mouth. If drugs are to be given, only those should be employed which will not disturb the stomach, and may to some extent improve general nutrition. Given with this object in view, some cases among older infants do undoubtedly derive benefit from the prolonged administration of iron. It may be given either in one of its acid preparations, or in a neutral and less irritating salt. Nutrition may also in some instances be assisted by the inunction over the abdomen or body generally, of codliver-oil, or cocoa-butter. The moderate employment of stimulants is called for in almost all cases. Great attention must be given to the dietary and to its proper regulation; and to this end the stools should be frequently examined. Fats are only to be allowed with much caution. Starchy foods should be more or less predigested. Considerable benefit may be derived from the employment of scraped meat, meat-juice, broths, and peptonized meat-foods. For younger infants milk-foods will require very careful preparation; and in some cases may have to be altogether discontinued. In older children they may be cautiously employed, always watching the stools for signs of undigested material. No absolute rules can be laid down suitable for all cases; each case must be studied by itself.

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In the treatment of infantile diarrhœa an absolute sterilized milk diet should be given, and the use of some mild alkaline water, such as that of Vals or Vichy, to which may be added some white of egg to form albumin-water.

Should the diarrhœa be so active as to deplete the patient to a dangerous extent hypodermoclysis or the subcutaneous injection of artificial serum or even of real serum should be employed. Lesage (Revue de Thérap. Médico-Chir., Dec. 15, '96).

We have before insisted upon the necessity of placing the patient under the most perfect hygienic conditions possible, and of securing abundance of fresh air. In the treatment of these cases our chief therapeutic reliance must be upon the administration of injections into the colon. Weak solutions of silver nitrate, if the bowels are thoroughly irrigated beforehand by simple sterile water, may prove of much service. The readiness with which this drug is decomposed appears to offer serious objections to its use. Preferable to it, in our opinion, will be found one of the salts of zinc (gr. iv-Oj), or tannic acid (gr. xxx-Oj), or the fluid extract of hamamelis (3i-3ii to Oj), or the colorless fluid extract of hydrastis (3i-Oj). Any one of these may be employed as a high injection after thorough irrigation by the normal saline solution. Opium should be made use of only to moderate excessive peristalsis,

and in these cases is best given in a little starch-water by rectal injection.

High rectal injections of value in the chronic diarrhœa of infancy in which there is a glairy mucous discharge due to an enteritis. In addition to ordinary water some extract of rhatany and mucilage of acacia may be injected. If there is any doubt as to the purity of the water, it should be boiled before it is injected. In other instances hyposulphite of sodium in the proportion of 2 drachms per pint of water, to which has been added a little mucilage of acacia, may be given night and morning in this manner, with advantage. Dauchez (Revue Mensuelle des Sciences des l'Enfance, May, '96).

The value of the administration of opium in this disease is a subject on which there has been much difference of opinion. All writers, however, agree that it should be avoided at the outset; but many indications for its employment, in our opinion, may arise during the latter stages of the disease.

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Indications and contra-indications for the use of opium in the diarrhœas of young children. It is contra-indicated: 1. In the first stages of acute diarrhœa, before the intestinal canal has been freed from decomposing matter. 2. When the passages are infrequent and of bad odor. 3. When there is a high temperature or cerebral symptoms are present. 4. When its use is followed by elevation of temperature or the passages become more offensive. It is indicated: 1. When the passages are large and watery. 3. In dysenteric diarrhœa, together with castor-oil or a saline. 4. In late stages, with small, frequent, nagging passages. 5. When the passages consist largely of undigested food, and the bowels act as soon as food is taken into the stomach. Crandall (Archives of Ped.; Med. and Surg. Rep., Sept. 25, '97).

Stimulants, in our opinion, are necessary in the majority of cases; they should be used cautiously at first, but liberally in the later stages of the disease. Good whisky and brandy are preferable to wines; aromatic spirit of ammonia may occasionally be of service in small frequently repeated doses. Caffeine may also be employed either in a single solution or in the form of a well-prepared tea or coffee.

In all instances where the temperature runs an elevated course we have much confidence in the value of hydrotherapy. This treatment may be employed in the form of cool baths, the cold wet pack, or cool irrigation of the intestines. Of the three methods our preference is for cool baths; whenever the temperature of the body rises above 102° F. the infant should be placed in a bath containing water at the temperature of about 95° F., which temperature should be quickly lowered to 90° F. or 85° F. A cloth wrung out of cold water should, at the same time, be kept on the head. The infant should remain in the bath from three to ten minutes; the duration varying according to the age and feebleness of the infant. It is to be remembered that infants are affected by a cold bath more promptly than adults, and are more easily depressed by it. Care should be taken, therefore, to watch its effects, and, if necessary, to use stimulants after it is over.

The patients should be bathed daily, or even twice daily if greatly prostrated, with sea-salt water, made by adding a handful of salt to about 4 gallons of water at about 80° F., at the end of the bath water of about 60° F. being poured over the whole body. Louis Fischer (Post-graduate, Sept., '92).

Great success in extreme cases of enteritis by the cold bath at a temperature of 68° F. Brunon (La Normandie Méd., Aug. 1, '93).

A cold wet pack may occasionally with advantage replace the cool bath where

circumstances are not convenient for the employment of the latter. Of late years the irrigation of the colon with cool water has been employed in cases of hyperpyrexia. It is unquestionably a more powerful method than either bath or pack, and when used with discretion may prove of more value. Its action, however, is less under the control of the physician than that of baths, and serious depression of the nerve-centres may result from the employment of too cold or too long-continued irrigation.

Should the prostration become extreme, or hydrencephaloid symptoms make their appearance, subcutaneous injections of a sterilized normal saline solution, as described in the article on Cholera Infantum, ought to be employed. In severe cases three or four injections a day of 30 cubic centimetres each should be given. Not only do these injections stimulate the flagging circulation, but they dilute the toxins in the blood and favor their elimination through the excretory organs; in many instances they check in a remarkable way the symptoms of nervous irritation.

Dietary.—For the first twelve or twenty-four hours, according to the severity of the case, only cool sterile water should be permitted to the infant. After this period a weak sugar-of-milk solution may be given in small quantities to infants under three months; to those over three months a thin barley- or rice- water sweetened with sugar of milk may be allowed. Great caution must be exercised with all albuminous foods so long as the stools retain their offensive odor. White-of-egg or albumin- water forms an excellent method of administering an easily-assimilated proteid. To prepare it the white of an egg is to be shaken up in a flask with from 6 to 12 ounces of water; the solution is then to be strained through muslin, and a little salt and sugar of milk added. A carefully-prepared whey may also be allowed, and is often relished. In older children raw meat-juice in small amount, a weak broth, or one of the peptonized foods may be administered with advantage. Milk in all forms should be forbidden until the stools begin to assume a normal appearance; its employment should then be resumed only gradually. As Siebert has emphasized in a recent paper, underfeeding of the infant with milk-sugar solution, thin gruel, or strained soup can do little harm; while milk even in small quantities can aid the infection, but not the nourishment of the body.

Hygiene.—During the attack the infant should, as far as possible, be confined to its cot. Soft unirritating flannel should be worn next the skin. Great care should be exercised lest the buttocks become irritated by the discharges, diapers should be changed promptly as soon as soiled, and the application of some greasy emollient will frequently prevent the development of the erythematous and sometimes ulcerative condition which in these cases is so liable to occur. The infant should be allowed all the fresh air possible. As soon as the violence of the attack has passed off, it should be sent, if practicable, either to the sea-side or to a bracing country- or mountain- air.

Inflammatory Diarrhœa in which in Addition to the Systemic Infection the Symptoms of an Acute Local Inflammation have a Prominent Part—Acute Ileocolitis (Holt).

Symptoms.—The symptoms in this form of disease generally commence abruptly, and for the first few days closely resemble those of the preceding form. The vomiting, however, is not

generally persistent: the temperature, although high at the onset, soon falls, and remains about 102° F., and the motions are of a greenish or greenish-yellow color and very frequent. After two or three days the discharges assume a more characteristic appearance. They become small in amount, are of a grass-green or brown color; contain a large quantity of mucus; a variable amount of blood; and are passed with much pain and straining. Such stools may either have a comparatively slight odor, or a distinctly putrid and offensive one. Under the microscope, undigested material, epithelial cells, pus-corpuscles, and streptococci, with other forms of bacteria, are seen.

The abdomen may now show signs of slight distension; tenderness on pressure may be elicited along the course of the colon, and the urine, if collected, may show the presence of a small amount of albumin. As the disease progresses the severe straining frequently leads to a distinct prolapse of the bowel.

If proper measures have been employed, the severity of the symptoms generally begins to subside toward the end of the first week. The motions now diminish in frequency: they no longer show signs of blood; pain and tenesmus lessen, and the mucus decreases in amount. In many cases, however, recovery is slow, and relapses on the slightest indiscretion are liable to take place. Much care is necessary lest the inflammatory process go on to ulceration.

The persistence for two or three weeks of brown mucous stools with moderate pyrexia, and a failing nutrition are, according to Holt, indicative that ulceration has taken place.

In the more recent form the temperature remains steadily high; the motions are very frequent and contain much blood; and the infant quickly falls into a typhoid state in which stupor, delirium, or convulsions are liable to occur. If the case survive, the symptoms may moderate; but prostration is extreme, and some pulmonary or cerebral complication is apt to turn the scale on the wrong side. Some ulceration is almost always present in these cases, retarding recovery for for many weeks. A long period, during which careful dietetic and medicinal measures must be faithfully employed, may still reappear before complete restoration to health is secured.

The membranous type if the disease is fortunately of rare occurrence. In this form the symptoms are of an alarming character from the very outset. Not only do the stools contain much blood and mucus, but an examination of these under water may reveal numerous shreds, and sometimes large patches of pseudo-membrane. Pronounced nervous symptoms, such as stupor or convulsions, may at the onset mark the symptoms of local inflammation. These cases run a severe course, typhoid symptoms develop early, and recovery is comparatively rare.

In some cases which for the first two or three weeks have shown symptoms of gastro-enteric infection rather than of local inflammation, owing either to the feeble constitution of the infant or to the intensity and duration of the local irritation, a follicular ulceration develops, and symptoms of local inflammation make their appearance. The motions now become small, slimy, and, to a variable extent, tinged with blood; their color is most frequently of a dark green or brown, and their odor usually offensive. Pain at this stage, though present, is no longer so prominent a feature as during the earlier stages of the disease; pyrexia is only moderate; the motions are not very frequent, but the strength of the infant gradually fails, and the general

emaciation becomes very noticeable. Under the microscope the stools are seen to contain epithelial cells in large numbers, numerous leucocytes, and streptococci associated with bacilli.

The course of these cases is generally downward. Exacerbations and relapses are easily excited. Only the few recover completely, and in these convalescence is always slow. The fatal result is frequently hastened by some intercurrent disease.

Diagnosis.—Like the preceding, this form of inflammatory diarrhœa is to be distinguished from intussusception. It is important to remember that with intussusception, although we may have vomiting, bloody stools, and tenesmus, we have no pyrexia. Later on, the absence of fæcal matter in what passes from the bowel, the tenesmus, the tympanites, the stercoraceous vomiting, and the slowly rising temperature complete a picture quite different from that of an ileocolitis. Typhoid fever, as we have before mentioned, very rarely presents itself in an infant.

A diagnosis of the presence of ulceration is to be made from the whole character of the case, rather than from any one special symptom. Where mucous stools persist for several weeks with only moderate fever, but with distinct wasting and loss of strength, a condition of ulceration is more than probable.

Prognosis.—The prognosis must be greatly dependent on the vitality and strength of the infant, upon the hygienic and dietetic conditions that can be secured, upon the severity of the attack, and upon the season of the year. Delicate infants under unhygienic conditions generally succumb early. Continuous high fever, the presence of a large amount of blood in the evacuations, severe nervous disturbances, and symptoms indicative of extreme feebleness of the circulation are always to be regarded as unfavorable.

Treatment.—The same measures are to be employed at the outset in this group of cases as in the preceding. Milk and all milk-foods are to be forbidden. A full dose of castor-oil or an effective dose of calomel is to be promptly administered, and followed within a few hours by copious irrigations of the colon with tepid saline solution (sodium chloride, 1 ounce; water, 1 gallon). The compress over the abdomen, which we have already advised as an excellent sedative, should also be applied. After the second or third irrigation of the intestines, should painful straining persist, a small quantity (℥ii-℥iv) of a thin starch solution, to which from 1 to 3 drops of tincture of opium, according to the age of the infant, has been added, should be gently thrown into the rectum, with the object of moderating excessive peristalsis and lessening tenesmus. These opiate injections may be repeated, if necessary, once or twice daily. Should the stools contain a large amount of blood, rectal injections of hot water, 106° F., to which a small amount of fluid extract of hamamelis has been added, may be administered for ten or fifteen minutes at a time, allowing the fluid to escape without hindrance. Tannic-acid and weak nitrate-of-silver solutions have both been recommended for use in this acute stage. We consider them of more advantage after the acute symptoms have, to some extent, subsided.

Internally, during the first few days of the acute stage a mixture containing castor-oil, in from 3- to 10-minim doses, associated with ipecac, and small doses of an opiate given at intervals of two or three hours, is strongly recommended by many writers, and has in our hands been of apparent benefit. Later, one of the

insoluble preparations of bismuth, to which we have before referred, should be given in full doses suspended in a mucilage with some aromatic water. Other and more powerful antiseptics may in some cases be employed. Stimulants are required in the majority of cases. Old brandy or whisky forms one of the best, and, given well diluted in a little sweetened or albumin- water, is acceptable even to the youngest infants.

All that we have said in the preceding section in reference to cool baths, dietary, and general hygiene is equally applicable in this class of cases.

Literature of '96-'97-'98.

Fifty-two children with grave diarrhœas treated with serum obtained from asses after injecting colon bacilli from virulent milk or stools. Twenty-six children had no marked symptoms after 48 hours, fourteen were improved, twelve unimproved. In all cases where the stools were green the color disappeared after the injections. The serum obtained after treating asses with the colon bacilli normally present in stools did not give these results. Lesage (Rev. de Thérap. Med.-Chir., No. 24, '96).

Between sixty and seventy cases of "summer diarrhœa" treated in children ranging in age from a few weeks to three years. The cases were in every way such as are met with in the crowded tenements of large cities during the heated term. Lactic acid was used in every case. The maximum dose was 1¼ grains, given every hour. The result was the disappearance of all symptoms in from twenty-four to forty-eight hours. The only medicine given besides the lactic acid was an initial dose of calomel in cases where it was indicated. Bowles (Indian Lancet, Apr. 1, '97).

Endoxin, which contains 52.9 per cent. of iodine and 14.5 per cent. of bismuth, recommended in the treatment of infantile diarrhœa. The remedy is harmless, and can be administered in doses of 1 grain every hour to a child a year old. M. Elerzarian (N. Y. Med. Jour., No. 1029, p. 270, '98).

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INFANTS, FEEDING OF. See Nursing and Infant-feeding.

INFANTS, SCORBUTUS OF. See Scorbutus, Infantile.

INFLUENZA.—From the Italian, *influentia*: a mysterious influence.

Definition.—Influenza, "*la grippe*," or epidemic catarrh, is an acute febrile affection generally accompanied by severe nervous and catarrhal symptoms, and often extending rapidly over many countries and attacking large numbers simultaneously, but resulting in a low ratio of mortality.

Symptoms.—Epidemic influenza is remarkable for the suddenness of its attacks and the number of persons affected at the same time. There is no well-defined period of incubation, and generally no prodromic stage. Persons apparently in good health and engaged in their ordinary occupations are suddenly attacked with sensations of coldness, often increasing to a chill, with general depression and severe pains in the head, back, and limbs. The surface looks pale, the pulse and respiration variable, but these symptoms soon give place to distinct febrile reaction, some flushing of the face, general feeling of soreness of the muscles, and increased intensity of pains everywhere, with great sense of weakness.

The pulse and respirations increase in frequency, and the temperature generally ranges from 38° to 40° C. The skin is dry, the urine is scanty and high colored; there is constipation, no appetite, but some thirst. In a large majority of cases

before the end of the first twenty-four hours the vessels of the conjunctivæ become red, accompanied by active congestion of the lining membrane of the nostrils, pharynx, and bronchial tubes, with cough and oppression in the chest. At first the cough is dry and harsh, causing some pain in the chest, and, in some cases, severe pain in the region of the frontal and maxillary sinuses. During the second day the congested membranes begin to secrete a thin, almost water-colored mucus that flows from the nostrils and renders the cough less dry, and on the third and fourth days the nasal discharge and the expectoration become more opaque or muco-purulent, causing more or less moist rhonchi in the chest. At the same time the pains in the head, back, and limbs and oppression in the chest become less severe, expectoration more free, temperature lower, especially during the morning hours, and by the end of the week the skin becomes bathed in perspiration, the kidneys secrete more urine, and convalescence begins.

In mild cases the patient usually quickly recovers his health and strength, but in those of greater severity, though the general febrile symptoms disappear at the end of the first week, the inflammation of the mucous membrane of the air-passages continues, perpetuating copious muco-purulent discharges from the nostrils, with some cough and expectoration, and the patient remains debilitated several weeks or even months.

Literature of '96-'97-'98.

In influenza of childhood there is a period of depression with some nasal catarrh, and slight dry cough preceding the onset of the fever. It may last eight or ten days. The onset of the pyrexia is marked by shivering, the voice becomes hoarse, deglutition is sometimes painful, the nasal catarrh increases, and there is some dyspnœa. Constipation is the rule, and in many cases there is severe headache, though, in infants, this may be replaced by convulsions. Furst (Scalpel, No. 16, '97).

Seven cases of influenza in adults, distinguished by extremely-copious sweats and a marked tendency to the formation of adipose tissue. The cases commenced with bronchial disturbances; some were accompanied by distressing cardiac palpitations, all with constipation, lack of appetite and scantiness of urine. The sweats continued for months and left a neurasthenic condition, which in some cases persisted for years. The sweats and bronchial disturbances alternated, one diminishing as the other increased, and *vice versâ*. Marquie (Jour. de Méd de Bordeaux, Apr. 16, '98).

In severe cases, when at the climax of the active stage, the inflammation often extends through the bronchial tubes to the air-cells and connective tissues of the lungs, thereby developing all the symptoms of broncho-pneumonia as a complication of the original disease.

The relation of influenza to pneumonia is that of a predisposing factor only. Prudden (Med. Rec., Feb. 15, '90).

The course of pneumonia complicating influenza is seldom that of the typical disease; it rarely sets in with a decided rigor, and the inflammatory symptoms, notably the pain in the side, are but little marked. The local processes are not characteristic. Local signs are not detectable before the third or fourth day. Crepitation will be heard over a considerable area, soon disappearing and becoming evident at another. Not often does the process reach hepatization with definite dullness. Typical rusty sputum seldom observed. Crises are rare. The course of inflammation is milder, dyspnœa and rapid infiltration being wanting. Leyden (Berl. klin. Woch., No. 10, '90).

Malignancy found characteristic of the pneumonia complicating influenza, seven of fourteen cases terminating fatally. Sokolowski (Internat. klin. Rund., Apr. 13, '90).

Pneumonia of influenza considered as a broncho-pneumonia. It presents the following distinctive features: 1. Evidence of a preceding attack of influenza is generally present. 2. Percussion-dullness may be absent or only present for a short time, shifting its position; bronchial breathing may be the only physical sign; moist sounds are most constantly present. 3. The sputum is never typically rusty. 4. The fever usually sets in without shivering, and the temperature rises gradually. 5. The course is less acute, the infiltration disappears slowly, and convalescence is retarded. Albu (Deutsche med. Woch., Feb. 15, '94).

Case of influenza-pneumonia followed by unmistakable signs of abscess of the lung, in which Pfeiffer's bacillus was the only organism found in the sputum. Hitzig (Münch. med. Woch., No. 35, '95).

Three cases of influenza-pneumonia which progressed to gangrene. Rhyner (Münch. med. Woch., Nos. 9, 10, '95).

Peculiarities of broncho-pneumonias of influenza in children: (1) slight elevations of temperature seem to point to paralysis of thermogenic centres; (2) early tendency to bronchoplegia and pulmonary collapse due to depression of vital powers; (3) extraordinary slowness of course of disease. Ferreira (Revue Men. des Mal. de l'Enfance, Mar., '95).

Literature of '96-'97-'98.

Influenza-pneumonia is characteristically lobular, the inflammatory process spreading from the bronchi to the alveolar passages and alveoli, the latter being densely and almost exclusively filled with leucocytes. In the bronchi their number is so great that they not only penetrate between the epithelial cells, but cause partial detachment of the epithelial lining. The absence of fibrin is noteworthy, and is one of the reasons why the infiltration has, to the naked eye, a smooth appearance.

As a terminal stage of influenza pulmonary gangrene occurred in 7.5 per cent. of the writer's cases of influenza-pneumonia. Arteriosclerosis may follow influenza. A. Fraenkel (Berl. klin. Woch., Apr. 12, '97).

The influenza bacillus is capable of giving rise to fibrous or serous, or even hæmorrhagic, exudate in the lungs, which may become purulent. When the sinuses communicating with the nose are inflamed it is nearly always a result of infection with the influenza bacillus. Lindenthal (Wiener klin. Woch., Apr. 15, '97).

Such a complication has been much more frequently manifested in childhood and old age than in the middle period of life. And it is one of the chief causes of the mortality attributed to influenza. Croupous pneumonia and pleurisy sometimes, though rarely, occur as complications in this disease.

If patient with influenza have also croupous pneumonia, the association is accidental. The invasion of the one but prepares the way for that of the other. Nothnagel (Internat. klin. Rund., Jan. 12, '90).

Respiratory complications rare and benign in children. Of 218 cases, bronchitis, usually of a mild character, was present in 18. Complications involving organs of special sense were relatively frequent. Comby (Revue Mensuelle des Malades de l'Enfance, Apr., '90).

In some of the wide-spreading epidemics of influenza, more especially those commencing during the summer and autumn months, there have been less symptoms of inflammation of the respiratory mucous membranes, and more in the membranous lining, the stomach, and viscera of the abdomen. Such was the case in very many of the attacks during the epidemic commencing in the autumn of 1889 and recurring to some extent almost every year since. There was the same suddenness of the attacks, and the same severe pains, not only in the head, back, and limbs, but in the epigastrium, with tenderness to pressure in different parts of the abdomen, nausea, and occasional vomiting and a disturbed condition of the bowels. The evacua-

tions both from the stomach and bowels, though not frequent, were generally mixed with mucus sufficient to show a catarrhal grade of general fever present, and sometimes led the practitioner to suspect that his patient was affected with typhoid fever during the first few days of his attendance.

In a few cases the abdominal symptoms centered more in the region of the duodenum and hepatic ducts. This was indicated by constant nausea, occasional vomiting, scanty and high-colored urine, yellow or jaundiced hue of the conjunctiva and skin, with much epigastric distress and general weakness.

Literature of '96-'97-'98.

Variety of influenza characterized by bilious vomiting described. The onset is sudden; occasionally there is a chill. Bilious vomiting occurs early and is abundant and sometimes obstinate. There may be anorexia, flatulence, marked abdominal swelling, pains localized in the right iliac fossa, constipation, headache, and more or less profuse night-sweats. Jasiewicz (Jour. de Méd. de Paris, June 6, '97).

In another class of cases the predominant symptoms are limited to the nervous structures of the body, and consist in not only violent pains and moderate general fever, but a general hyperæsthesia throughout the cutaneous and muscular structures of the body. Muscular movements, both voluntary and involuntary, are painful. These give rise to a distressed feeling of constriction around the chest and soreness, with much pain in different parts of the line of attachment of the diaphragm, the pectoral muscles, and in the region of the heart. Both cardiac and respiratory movements are variable or irregular, a feature adding much to the general sense of prostration. In a few instances it has caused feelings so closely resembling those in angina pectoris as to greatly alarm the patients.

The exceptionally severe pains about the chest and pains in different parts of the body in influenza might well be considered partly due to general neuritis or perineuritis of varying degrees of intensity. Pepper (Med. News, July 5, '90).

Literature of '96-'97-'98.

Attention drawn to influenzal angina, which bears a marked resemblance to angina pectoris, with which, indeed, it is probably identical, being produced under the same conditions, and accompanied by the same symptoms.

The duration of these sensations is variable, for the most part lasting some time. The variability of these cardiac affections depends on whether the vagi, the sympathetic, or intracardiac ganglia are affected, or they may even depend on a bulbar origin. Batz (Thèse de Bordeaux, '96).

In this class of cases especially, and to some extent in all severe cases of each cavity, the functions of the cardiac, vasomotor, and respiratory nerves remain impaired for a long time after general convalescence is established. Consequently the patients do not regain ability to take active physical exercise without shortness of breath, palpitation, and a sense of great weariness for months—and, in some, years—after the original attack. All the varieties of influenza have, in rare instances, been complicated with inflammations of the brain or its membrane, of the endocardial structures, the urinary organs, and even the uterus.

Meningitis may arise directly as a result of the general infection, in which case it occurs during the progress of the disease; or, secondarily, to otitis, in which case it occurs after the influenza has disappeared. The myelitis of influenza may be diffuse or systemic. The most frequent variety of the former has been transverse dorsal myelitis.

The complications of the peripheral nervous system are the most common, and, among these, neuralgia takes first rank. Trigeminal neuralgias are most frequent. Disorders of motility are much less common than those of sensibility. Influenza may reawaken neuroses from which the patient has long been free, exaggerate existing or even provoke the explosion of neuroses in those who have never been affected. These nervous complications distinguish influenza from dengue. De Brun (La Méd. Moderne, Nov. 13, '90).

Renal congestion and inflammation of frequent recurrence in the course of influenza; diagnosis greatly facilitated by the use of the centrifuge. These conditions appear at the same time as those that occur in the course of diphtheria and typhoid fever, and are in each instance probably due to the toxins of the respective diseases. Microscopically the urine under these circumstances contains a small amount of blood, with hyaline casts strewn with granular matter and epithelial cells, and also granular casts of the thin variety. In the nephritis of scarlatina, on the contrary, the casts are of the wider variety. In the majority of case recovery ensues in from two or three weeks to two or three months. Some, however, pursue a chronic course. A. Jacobi (Med. News, June 8, '95).

Renal lesions are not infrequent following influenza. Besides transient albuminuria has been observed acute degeneration of the kidney, acute inflammation, both forms of chronic diffuse nephritis, acute hæmorrhagic nephritis, and persistent albuminuria not belonging to any of these groups. The number of applicants rejected for life-insurance has perceptibly increased since the advent of influenza in epidemic prevalence. G. Baumgarten (Med. News, June 8, '95).

Several cases of albuminuria in patients free from renal trouble before influenza. So-called healthy albuminuria becomes more serious after influenza, and casts appear in the urine. James Tyson (Univ. Med. Jour., July, '95).

The poison acts very often on kidneys. In the simplest cases of influenza there is sometimes severe inflammation of glomeruli, with slight albuminuria, which lasts for several days, then disappears. In other cases it produces serious nephritis, which from the start exposes the patients to renal insufficiency and death from uræmia. Lamarque (L'Union Méd., Sept. 28, '95).

Case of hæmorrhagic nephritis noted consecutive to grippe, in a woman 32 years of age, the hæmaturia lasting three weeks. Thorough recovery ensued. Bock (Deutsche med.-Zeit., Apr. 2, '94).

Case of influenza in which hæmorrhages occurred with suppression of urine, and later an enormous amount of albumin. Anæmia supervened, followed by neuritis and death. F. C. Shattuck (Univ. Med. Jour., July, '95).

Case of cystitis, caused by influenza, characterized by pain in the lower part of the abdomen; painful micturition, hæmaturia at the end of the act on eighth day of the disease. Yielded readily to treatment. Comby (Med. Bull., May, '95).

One writer states that, in 27 cases of the disease occurring in pregnant women under his observation, abortion or miscarriage took place in 17.

Series of 159 cases of influenza observed, 138 in the non-gravid and 21 in the pregnant condition. Of the latter, pregnancy was interrupted in 17 cases, and in 4 continued its course. The 138 non-gravid cases showed in all, with the exception of 3, alterations in the generative functions—partly by menorrhagia, partly by metrorrhagia, partly by exacerbations of already-existing sexual pains. Hæmorrhagic form of endometritis set in which led, in the pregnant state, to abortion or interruption of the pregnancy. Rudolf Müller (Münch. med. Woch., Oct. 8, '95).

Literature of '96-'97-'98.

Of the four clinical forms—the purely febrile, the nervous, the catarrhal, and the gastric—women suffer most from the first two. Symptoms connected with the genital organs are very common, and menorrhagia and intermenstrual discharge are frequent. Pre-existent dis-

cases, such as endometritis, congestive or infectious, show exacerbations.

In a school, chlorotic and anæmic girls in whom menstruation was irregular, the flow became and continued regular after an attack of influenza.

Pregnancy and labor were commonly gravely affected, and many abortions and premature labors occurred during the several epidemics. Labor-pains were weak and specially painful, and the confinement was prolonged. Gabriel v. Engel (Wiener med. Presse, Nos. 43, 44, '96).

Attention called to the fact that, during the 1890 influenza epidemic, the number of births in Hungary was 41,866 less than during previous years, and during the following three years; during September and October alone in 1890, there were 19,768 less children born than in the same months of other years. Engel (Centralb. f. Gynäk., No. 24, '97).

Observations upon 50 women who had grippe during pregnancy or the puerperal state.

In pregnancy grippe affected the nervous system profoundly in 1 case, the gastro-intestinal tract in 2 others, while in the majority the respiratory organs were attacked. In 1 of the intestinal cases, pyelitis developed. The majority of pregnant women in whom grippe affected the respiratory organs recovered without especial difficulty. A small number had pneumonia, which proved a serious complication. In 1 patient otitis and meningitis developed, both caused by the pneumococcus. The sputum of these showed abundant pneumococci.

So far as the influence of grippe on the continuation of pregnancy was observed, but a very few cases had metrorrhagia. Labor itself was not especially influenced by grippe. Bar and Boulle (Amer. Jour. Med. Sci., Dec., '98).

One of the most constant and important influences accompanying epidemics of influenza is a marked impairment of vitality or vital resistance, as shown in continued loss of strength and endurance, mental despondency, and increased attacks of bronchitis, pneumonia, and tuberculosis, not only during its active prevalence, but for many months thereafter.

Ten cases of psychoses following influenza seen at the clinic at Bonn. The mental disorder set in during convalescence, and was preceded by a sense of fatigue and obstinate insomnia. It was initiated by acute delirium, which in all cases but two passed into melancholia of variable duration. The prognosis is favorable. More than half of the 10 cases possessed a neuropathic heredity, and 2 "nervous irritability." Convalescence should be carefully watched and signs of mental aberration combated with stimulants and restoratives. Mispelbaum (Zeitschrift f. Psychiatrie und Gerichtliche Med., B. 47, H. 1, '90).

Influenza may be the sole etiological element in the development of a psychosis, or it may merely act as an exciting factor in disturbing the equilibrium of a nervous system already deranged or in intensifying a latent mental disorder. Kern (Münch. med. Woch., Apr. 29, '90).

Influenza is responsible for none of the cases of true psychoses, inasmuch as in 104 cases only 21 were found in which neither hereditary tendencies nor alcoholism nor neurotic temperament was absent. Jolly (Deutsche med. Woch., Mar., '91).

Fifty-four cases of insanity following influenza. About one-fourth may be classed among the cases of febrile delirium. They begin as acute hallucinatory confusion, contemporaneous with the fever, and disappear several weeks after the latter has subsided. The postfebrile cases may be divided into three classes. 1. Asthenic psychoses with hallucinations and delusions, sometimes exaltative, at others depressive. 2. Melancholias, from simple neurasthenic or hypochondriac disturbance to profound stuporose conditions. 3. The manias. The prognosis is good. Kirn (Allgemeine Zeitsch. f. Psy. u. Psy.-gerichtliche Med., B. 48, '92).

The nervous and mental consequences of influenza in the majority of cases are poisoning by some ptomaine produced by the bacteria of the disease. P. C. Knapp

(Boston Med. and Surg. Jour., Sept. 15, '92).

Influenza can only be directly followed by tuberculosis when a pre-existing tubercular infection was present. Dubrandy (La Semaine Méd., July 29, '91).

Case of bilateral neuritis of the brachial plexus suddenly followed influenza. Complete paralysis of the arms occurred, with atrophy and reaction of degeneration in the paralyzed muscles. The father of the patient had been similarly affected in the lower members also after influenza. M. A. Claus (Jour. de Méd., de Chir., et de Pharm., May 26, '94).

Neuritis of the optic nerve due to *la grippe* is of relatively rare occurrence; it may affect one or both eyes, and may produce partial transient impairment of vision, partial permanent impairment of vision, or absolute permanent blindness. Failure of vision begins from three to fourteen days after the commencement of the attack of *la grippe*, and proceeds rather rapidly. It is always preceded by intense frontal or circumorbital cephalalgia. Treatment has but little effect to promote a cure. If recovery follows, it takes place spontaneously and accompanies improvement in the patient's general condition. Weeks (N. Y. Med. Jour., Aug. 8, '91).

From the study of twenty-seven reported cases of papillary and retrobulbar neuritis, following influenza, the following conclusions are drawn: 1. The virus of influenza may attack the optic nerve in its papillary or in its retrobulbar portion. 2. The ocular lesions of influenza may be divided into those produced by infection from the exterior and those caused by metastasis. 3. The papillitis, due to influenza, appears in from three to fourteen days after the commencement of the disease. 4. Retrobulbar neuritis is more common than papillitis or neuroretinitis. It differs from the neuritis due to alcohol, tobacco, or lead, in that it presents an acute or a subacute form, marked by a rapid and progressive diminution of vision. Prognosis should be guarded, improvement being slow, sometimes, though exceptionally, being complete. During the acute stage leeches to the temples, absolute rest, injections of pilocarpine, quinine, and salicylates internally should be employed. In the later stages iodide of potassium, the continuous current, injections of strychnine into the temples, and mercury are indicated. Antonelli (Recueil d'Ophtal., June, '92).

Influenza is a specific nervous fever and, like cerebro-spinal fever, is infectious. Backache, spinal; headache, delirium, tinnitus, etc., due to implication of cranial nerves; vomiting and diarrhœa probably reflex; complications mainly nervous. H. Waite (Brit. Med. Jour., June 22, '95).

Case in which several weeks after influenza, when weather extremely severe, patient noticed paralysis of muscles supplied by facial nerve, first left side then right. Brother and father had had facial palsy. W. J. Barkas (Lancet, Jan. 26, '95).

Case of transitory aphasia following influenza. Dargelo (Nouveau Montpellier Méd., July 20, '95).

Aphasia observed in the course of influenzal pneumonia. Pailhas (Arch. de Neurol., May, '95).

Two cases of cerebral sclerosis following influenza. Rendu (Le Prog. Méd., Jan. 5, '95).

Literature of '96-'97-'98.

Man, aged 40, a tailor, alcoholic and very neurotic, had been under personal observation during the last and the present year, suffering from a recurrent desquamative affection of the skin following influenza.

In February, 1895, he had a typical severe attack of influenza, and was in bed a month with it. He does not think he had any rash. In the beginning of March his hands and feet began to peel and his nails to become dry and brittle. He came under observation on March 21st, when the following note was made: "Over both hands the epidermis is peeling off in large sheets, especially from the fingers, leaving the subjacent skin healthy. There is hypertrophy of the nail-bed of all the fingers, and especially of the thumbs, where the piling up of epidermis is so great as to threaten the vitality of the nail. There is a similar

desquamation of the soles and similar changes in the toe-nails, but less marked. The man is in a marked condition of post-influenzal neurasthenia."

Subsequently all his nails fell off, and were replaced by new nails with prominent transverse ridges. His nervous prostration persisted; he complained of persistent "paralytic feelings" in the fingers, and disordered sensation. Finally he became profoundly melancholic, but improved greatly at a convalescent home at the sea-side.

He had another attack of influenza in October, 1895, followed by similar changes and total loss of nails, and again in February, 1896. Recently he had a fresh attack, called "bronchitis," and he returned to the hospital on November 4th with desquamation of all the fingers, although more marked in some than in others. There is, on examination, no anæsthesia, but some loss of tactile sensibility. J. J. Pringle (Brit. Jour. of Derm., Dec., '96).

The great majority of cases of multiple neuritis following influenza are, in reality, instances of peripheral neuritis, an intoxication of the nerve-trunks; this may be sufficient to produce rapid destruction of the nerve-fibres or just enough to cause pain by irritation. This is sustained by the fact that the salicylates are useful in these cases, owing to their power of promoting the elimination of some toxic agents. H. B. Allyn (Jour. Amer. Med. Assoc., July 24, '97).

In some cases presenting otalgia the subjects had moderate fever, but the aural pain was intense, and lasted from three to nine days. No evidence of an inflammatory process could be observed on examining the ears. These cases believed to be examples of pure otalgia, constituting an abortive form of epidemic influenza. D. Kaufmann (N. Y. Med. Jour., Feb. 13, '97).

The most common of nervous sequelæ is neurasthenia. The neurasthenia following influenza differs but little from the various recognized types of this affection. We meet with the cerebro-spinal, the spinal, and the sympathetic type. A noteworthy feature of the cerebro-spinal type is the great depression, amounting to melancholia, with suicidal tendencies; so that the term neurasthenia no longer applies to this affection.

The spinal form of neurasthenia is a less common sequel of influenza. In a few cases observed it was accompanied by marked symptoms of hysteria.

In the sympathetic variety we meet with a group of symptoms, some relating to the heart, others to the sexual organs. Bradycardia, with a slow pulse of 40 or 50, is often observed to occur with influenza; we meet with an irregular or intermittent pulse accompanied by attacks of syncope; occasionally also attacks of the nature of angina pectoris have been noted following influenza, where there was neither gout nor arteriosclerosis, or any other palpable cause for the attacks. In some cases the myocardium is most likely also affected, which may account for the sudden death occurring after influenza.

Among the post-influenzal nervous affections of an organic nature is most important peripheral neuritis. Various forms of peripheral neuritis have been observed. In a few cases all four extremities are affected.

Much more common than the former is a more limited neuritis, affecting sometimes only one limb or the two limbs on one side. The affection comes on some days or a week after the recovery from the influenza, the patient complaining of more or less severe pain in the limb, some weakness of certain groups of muscles comes on; in the lower extremities the anterior group of muscles of the leg and flexors of the knee are mostly affected; in the upper extremities the scapulo-humeral muscles, or sometimes the extensors of the wrist and fingers become involved; there is generally, also, disæsthesia; the reflexes are first increased, afterward diminished, but rarely become quite absent. Recovery is generally very slow.

A third form resembles diphtheritic paralysis. Here there is paresis of accommodation, and in some few cases pharyngeal and laryngeal paralysis, and it is perhaps a nuclear affection rather than a peripheral neuritis. J. Dreschfeld (Med. Chron., Mar., '98).

A case of sclerosis of the tongue of influenzal origin. The middle portion of the tongue was of a wooden hardness. This condition followed an attack of influenza in a person of middle age. The pathological change involved the cheeks also. Iodide had no effect upon the disease. Another case was described in which the tongue had assumed an atrophic and mammillated state after an attack of the same affliction. M. Courtade (Laryngoscope, Jan., '98).

While the foregoing history and symptoms of influenza relate to its true epidemic prevalence, it is proper to state that sporadic cases, presenting all the more characteristic symptoms, are met with during every winter in the temperate zone, particularly during the first two or three days of high temperature following a week of intense cold.

Diagnosis.—The coincident development, without premonition, of general febrile symptoms, violent pains in the head, back, limbs, and various parts of the chest or abdomen, catarrhal irritation of the membranes of the respiratory passages or alimentary canal, or both, with mental and nervous depression, is so characteristic of this disease as to render the diagnosis easy.

[An ordinary attack of influenza lasts from three to ten days; of dengue, from one to three weeks. The former is marked by muscular debility; the latter, by intense articular pain, especially at the knees, occasioning a characteristic limping gait. Catarrhs of the various mucous membranes constitute the rule in influenza, the exception in dengue. The latter presents a characteristic eruption. In influenza eruptions are rather exceptional, and, when present, variable. The temperature of dengue is apt to be remittent and higher than that of influenza. Convalescence from influenza is generally rapid; from dengue, slow and tedious.

For a few days influenza and typhoid fever might be confounded with one another. The former, however, does not present the dilated pupil so often seen in the latter, nor ever a rose rash; the temperature-curves of the two diseases are distinctly different, and the characteristic stool of typhoid fever is wanting in influenza. J. C. Wilson and S. Solis-Cohen, Assoc. Eds., Annual, '91.]

Peculiarity of the tongue observed in cases of influenza, and which is believed to be characteristic. It consists in an appearance of porcelain-like whiteness, associated with humidity. The coloration is sometimes uniform, sometimes mottled. It makes its appearance within the first two or three days of the attack, and sometimes persists until the patient believes himself well. Faisans (Le Bull. Méd., May 28, '93).

Peculiar vesicular eruption on the soft palate considered characteristic of influenza. The eruption consists of little vesicles resembling sago-grains, of from 0.5 to 1.0 millimetre in diameter. Shelly (Brit. Med. Jour., Apr. 15, '93).

Attention drawn to a peculiar condition of the tongue noticed in cases of influenza: the appearance of dark, purplish-red spots scattered over the anterior half of the dorsum, about the size of a pin's head, becoming white and vesicular later on; the latter also noticed on the inside of the mouth and soft palate. John Terry (Lancet, Oct. 12, '95).

Diagnosis of influenza during puerperal state. Marked and repeated chills; severe pain in the head, body, and extremities; gastric and pulmonary disturbances. Pain and soreness sufficiently characteristic to establish the differential diagnosis between it and puerperal fever. T. M. Burns (Annals of Gyn. and Ped., Sept., '95).

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Symptoms of otitis of grippal origin:—

1. At the outset of the otitis phlyctenules filled with blood appear on the tympanic membrane, and sometimes cover it completely, but rarely appear on the walls of the auditory canal. When the phlyctenules break and blood oozes from them, the membrane itself is at first not yet broken through to give exit to pus from within the tympanum.

2. Perforation occurs through a kind of baggy prolapse of the tympanic membrane.

3. Tendency to early complications with processes rapidly destructive in the mastoid, acute caries and necrosis, thrombosis of sinuses, pyæmia. Osteitis may occur at the outset, developing quietly without accompanying signs of inflammation of the tympanic cavity, which may be invaded later.

4. Persistence of pains and buzzings of the ear, often more prolonged after the perforation than in non-grippal cases. The membrane once more healed and the scar closed by cicatrix, deafness may persist, though repair seems perfect.

These four characteristics, even in the absence of bacteriological confirmation, will establish the diagnosis from non-grippal otitis media. Loewenberg (Le Bull. Méd., Mar. 2, '98).

The fact that many in the same community are attacked simultaneously or in quick succession renders the clinical diagnosis more complete; yet some of the first cases observed are generally denominated violent "colds," and when not severe are treated with domestic remedies without the aid of a physician.

Etiology.—At the present time a large majority of medical writers and teachers assume that influenza is an infectious disease, caused by a specific bacillus. And they generally point to the bacillus discovered in the pus-cells of the tracheal mucus by Pfeiffer in 1892, and in the blood by Canon the same year, as the essential cause of this disease. To the toxins developed by this micro-organism are also attributed the many and important complications and sequelæ that accompany or follow a large proportion of the attacks. As early as the middle of the present century it was suggested by Dr. J. K. Mitchell, of Philadelphia, that the disease was caused by minute cryptogamic bodies in the air. In 1868 Dr. J. N. Salsbury, of Cleveland, claimed to have discovered a species of infusorium in the nasal discharges of a considerable number of cases which he regarded as the essential cause of the disease. The extraordinary rapidity of the spread of the disease over whole continents led nearly all of the older writers to attribute it to sudden and extreme changes in temperature, moisture, and electric conditions of the atmosphere, but no uniformity of such changes has been found in different epidemics.

Influenza is independent of hygrometric, thermometric, and barometric changes. Greenley (Amer. Pract. and News, Mar. 15, '90).

Atmospheric conditions bear an important relation to the spread of the infecting agent: the micro-organisms are carried high up by the warm currents and are precipitated again to the stratum in which they are effective by the eddies which the cold currents produce. Ucke (St. Petersburger med. Woch., Feb. 17, '90).

Transmission of the disease from person to person is the exception; the dissemination of the disease is accomplished through the atmosphere. Combe (Revue Méd. de la Suisse Rom., May 20, '90).

Influenza is neither contagious nor imported from other localities than those in which it appears, but the microbe of influenza is identical with that of simple coryza, which has attained its "*summum potentiæ*" through favorable telluric or climatic conditions, such as those of temperature or humidity of the atmosphere. Otremba (Bull. de la Soc. des Méd. et Nat. de Jassy, Nov. 3, '90).

Influenza is a specific disease occurring under conditions constantly the same, due to atmospheric influences and complicated by the pathogenic germs at hand. Kowalski (Wiener klin. Woch., Apr. 3, '90).

Influenza is a paresis, or partial paralysis, of the pneumogastric nerve, depending probably on such a sudden change in the atmosphere as involves an increased expenditure of force in maintaining circulation and respiration. The best remedies

are strong excitomotor stimulants, chief among them strychnine, caffeine, alcohol, and ammonia. Morris (Jour. Amer. Med. Assoc., Jan. 3, '91).

The infection is due to a miasmatic chemical material derived from the atmosphere. Leyden (Deutsche med.-Zeit., Feb. 27, '90).

Miasmatic origin supported. Osler (Amer. Jour. of the Med. Sci., Apr., '90).

In the district prison at Freiburg: Of 406 prisoners, 35 per cent. were stricken: of those in solitary confinement, 30 per cent.; of those in the common wards, 50 per cent.; of those in communication with the outer world, 70 per cent. The restriction of the outbreak to different corridors shows that it was not due to a miasmatic influence. Kirn (Aerztliche Mittheil. aus Baden, Karlsruhe, vol. xliv, No. 7, '90).

Operation on the nose should not be performed during an epidemic of influenza, as operations usually cause a relapse, with marked depression. The wound invites infection. Delavan (N. Y. Med. Jour., June 8, '95).

There can be no influenza without Pfeiffer's bacillus. De Renzi (La Clin. Mod., Dec., '95).

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The influenza bacillus is capable of giving rise to fibrous, serous, or even hæmorrhagic, exudate in the lungs, which may become purulent. When the sinuses communicating with the nose are inflamed it is nearly always a result of infection with the influenza bacillus. Lindenthal (Wien. klin. Woch., April 15, '97).

The inmates of insane asylums are less liable to be affected with influenza at the time of an epidemic than the inmates of other large institutions, such as barracks, workhouses, etc.

An attack of influenza does not materially affect the disease from which the insane patient at the time suffered, yet in some cases the effect was a beneficial one. J. Dreschfeld (Med. Chronicle, Mar., '98).

Careful meteorological observations and records kept in Chicago during the prevalence of the epidemic of 1889-'90 showed the presence in the air of a decided excessive amount of both free and albuminoid ammonia, with almost entire absence of ozone. Whether such conditions of the atmosphere could foster the rapid evolution of the bacillus of Pfeiffer could be determined only by similar records kept through both epidemic and non-epidemic periods. That the disease is caused by some infectious or bacterial agent, capable of rapid development and wide diffusion in the air, is proved by the suddenness of its attack, the large number attacked at the same time in a community without any communication with each other, and its simultaneous outbreak in places widely separated from each other. Thus, in the last great epidemic, beginning in the autumn of 1889, it was recognized in St. Petersburg in October, in Central Europe in November, and in England, Massachusetts, Connecticut, New York, Pennsylvania, Rhode Island, Ohio, Indiana, Illinois, Wisconsin, and Kansas during the last week of December, 1889 (see Jour. Amer. Med. Assoc., volume xiv, pp. 817-822). To the same import is the fact that the passengers and crew on board of ships have been attacked on the ocean two weeks after any communication with the land. And also the fact that hermits and other persons in complete isolation have suffered severe attacks at the same time with those in the general community. The bacillus discovered by Pfeiffer, and claimed to be the essential cause of influenza, is very small, non-motile, and stains well with methylene-blue.

It is found in great numbers in the nasal and bronchial muco-purulent discharges during the active progress of the disease, and sometimes remains in those localities several weeks after the recovery of the patient. It has been found penetrating other tissues and in the blood,

though much less abundantly, and on culture-media it is said to grow only in the presence of hæmoglobin.

The bacilli of influenza appear as very tiny rods of about the thickness of the bacilli of mouse-septicæmia, but only half the length of these. Often three or four bacilli are strung together in the form of a chain. They stain with some difficulty with the basic aniline dyes. Better preparations are obtained with dilute Ziehl's solution or with hot Löffler's methylene-blue. In this way it can be seen, almost as a rule, that the two ends of the bacilli take the stain more intensely than the centre; so that forms are produced that can with difficulty be distinguished from diplococci or streptococci. They cannot be stained by Gram's method. In hanging drops they are immobile. Pfeiffer and Kitasato and Canon (Deutsche med. Woch., Jan., '92).

In a series of observations of influenza, embracing about 30 cases, the diplococcus pneumoniæ of Fraenkel and Weichselbaum was the predominant form. In six series, embracing 60 or more cases, streptococcus pyogenes were found in the lungs, sputum, and other secretions, and in various exudations.

They probably have not been the cause of the influenza, but have developed as the influenza has provided them with a suitable condition for growth, and this development may have caused some of the complications. Dowd (Med. Rec., Mar. 29, '90).

Influenza microbe can easily be cultivated; appears, in different stages of its growth, as a diplococcus, a bacillus, or a streptobacillus; appears not only in the blood, but also in the various tissues. Trouillet (Med. Press and Circ., Mar. 6, '95).

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The influenza bacillus, 0.5-1 x 3 microns, reacts peculiarly to staining agents, the poles being deeply stained, with an unstained equator, thus causing a close resemblance to a diplococcus. It is readily stained with dilute carbol-fuchsin, or Löffler's blue solution. It is difficult of cultivation, but there can be no difficulty in detecting it on cover-slips of the catarrhal secretion. Eugene Wasdin (Penna. Med. Jour., Nov., '97).

Pathology.—Ordinary post-mortem examinations reveal no structural changes peculiar to this disease. There are congested and inflammatory conditions of the mucous membrane either of the respiratory passages or of the digestive organs, or both. In some cases such inflammations have extended into the frontal sinuses, the maxillary antrum, and to the middle ear, and in more cases there are evidences of pneumonia.

Ocular lesions seen in influenza are manifold, but, if any predilection is shown, it is for the optic nerve and retina, and for the various periorbital sinuses. In panophthalmitis enucleation should be deferred when the infection is from a general cause and the patient is in bad condition; but when the origin is local and the general condition is good it should be performed at once. Panas (Revue Gén. de Clin. et de Thér. Jour. des Prat., Apr. 20, '95).

Eye complications following grip are comparatively rare. Grip may affect the eye by inflammatory process or by invasion of the accessory sinuses. It may affect the nervous tissues. The inflammatory affections involve especially the conjunctiva, the uveal tract, tissues of the orbit, and perhaps the fibrous capsule of Tenon. The nervous apparatus of the eye is especially liable to become involved by paresis of accommodation or of the extrinsic muscles of the cervical sympathetic, by papillitis and retrobular neuritis, and also anæsthesia of the cornea may occur. Pooley (Amer. Jour. of Ophthal., May, '95).

One hundred cases of aural and cutaneous complications seen in epidemic of influenza. Although very painful, the patients spending sleepless days and nights from the agonizing pains shooting through the head and shoulders, the cases, as a rule, ended in complete recovery in a comparatively short time. Eitelberg (Brit. Med. Jour., July 19, '90).

Hæmorrhagic otitis media described as

characteristic of the epidemic. It sets in between the third and seventh day of the disease, and is attended with hæmorrhagic effusion into the tympanum, manifested by intense pain. Spontaneous perforation usually takes place in the course of twelve hours. Haug (Münch. Med. Woch., Jan. 21, '90).

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The presence of the influenza bacillus exerts a very unfavorable influence on the bony structures of the ear, often converting apparently very simple cases of acute suppurative otitis into very malignant ones, with rapid destruction of bone, and this without marked symptoms. This tendency to rapid bone-destruction should be constantly kept in mind, and can be prevented only by early and, if necessary, repeated paracentesis. Wells P. Eagleton (N. Y. Med. Jour., Aug. 7, '97).

But all these are regarded rather as complications than as essential features of the general disease. The general febrile symptoms appear to result from the direct action of the bacillus or its ptomaines on the corpuscular elements of the blood and of the cerebral-nerve centre, creating great pain and soreness, with marked depression and impairment of vital resistance. This view is sustained by A. Cantani, Jr., who injected cultures of the influenza bacillus into the brain of rabbits, by which severe nervous symptoms were produced, and from which he inferred the bacillus to be an intracellular poison acting primarily on the central system.

In post-influenzal meningitis no lesion whatever to be found at necropsy, either in brain or medulla. In rare cases, suppurating lesions of the brain and meninges found. T. C. Maxime (Lancet, Apr. 13, '95).

Literature of '96-'97-'98.

Effect of intracranial inoculation of the influenza bacillus in rabbits studied. Virulent cultures were introduced into the brain by trephining. Severe nervous symptoms, high temperature, and death followed in about twenty-four hours. At the autopsy at the site of the wound was an œdema containing numerous influenza bacilli and hæmorrhages. The meninges were hyperæmic and infiltrated with hæmorrhagic exudation. The brain was markedly hyperæmic, the ventricles often containing a purulent exudation in which numerous influenza bacilli were found. The substance of the brain, on section, showed many small hæmorrhages and numerous bacilli, with polynuclear leucocytes. The bacilli appeared to spread, especially by the lymph-channels. The spinal cord was also invaded to a slight extent, the bacilli passing by the way of the central canal. The processes were generally those of a myelitis, similar to the encephalitis of the brain, but not nearly so severe. The other lesions present were bloody, serous exudate in the peritoneal cavity, acute congestion of the spleen, hyperæmia of the kidney, small hæmorrhages into the suprarenal bodies, and incipient fatty degeneration of the liver. The lungs were injected. Practically the same results could be obtained by inserting a few milligrammes of the dead growth of the bacilli (killed by heat) beneath the dura mater. This proves that the toxins are the really actively hurtful agents. Cantani (Zeit. f. Hyg. u. Infect., B. 13, '96).

Three cases of influenza which terminated fatally, in which the presence of Pfeiffer's bacilli in the nervous centres was ascertained. A. Pfuhl (Zeits. f. Hyg. u. Infect., p. 112, '97).

Prognosis.—The mortality from uncomplicated cases of influenza is very small, probably not exceeding 0.25 of 1 per cent. While this is true, it is equally true that during the prevalence of an influenza epidemic the mortality from tuberculosis, pneumonia, bronchitis, and typhoid fever is greatly increased.

[Of 528 deaths attributed to influenza, 46 resulted from the uncomplicated disease, 39 from senility, 49 from phthisis,

273 from croupous and broncho-pneumonia, 81 from other affections of the lungs, 5 from pleurisy, and 2 from empyema. Thirty-three deaths were noted from cerebral affections in the course of influenza. Axel Ulrik, Cor. Ed., Annual, '91.]

During the three months—January, February, and March, 1890—constituting the period of active prevalence of the epidemic for that year the number of deaths reported to the Register of Vital Statistics of Chicago, from the four diseases just named, were nearly 100 per cent. greater than during the corresponding months of the preceding year. The effect in diminishing the normal vital resistance is longer manifest in regard to typhoid fever and tuberculosis than in any other general diseases. One attack affords no immunity to subsequent attacks of the influenza, and there are no known prophylactic measures of value.

Marked immunity from influenza observed among the inhabitants of Madeira who had been recently vaccinated. In the epidemic of influenza those that had been vaccinated remained free, while those that had not been vaccinated were rapidly infected. This fact suggested as an explanation of the comparative infrequency of influenza among children. Goldschmidt (Berl. klin. Woch., Dec. 8, '90).

Of 241 cases of influenza, 86 had recently been vaccinated. Bienfait (Union Méd. du Nord-est, Apr., '91).

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The influenza bacillus, like the streptococcus, the diplococcus, and a few other pathogenic bacteria, is of such a nature that immunity cannot be attained. Delius and Kolle (Zeit. f. Hyg. u. Infect., Apr. 13, '97).

The rate of relapse in influenza is not less than 10 per cent. A previous attack rather predisposes than immunizes, and, if protection be afforded, it is so short as to be clinically negligible. Turney (Lancet, Feb. 5, '98).

Treatment. — The discovery of the bacillus by Pfeiffer as the supposed specific cause of influenza has not been followed by the discovery of a special remedy, either for its destruction or for reliably counteracting its effects upon the human system. Consequently we must be guided in our choice of remedies by the prominent functional disturbances presented in each case. These are generally diminished eliminations from the skin and kidneys; congestion of the mucous membranes, especially of the nasal and respiratory passages; and severe pains and soreness throughout the nervous and muscular structures of the body. To allay the pains and soreness and restore more active eliminations from the skin, kidneys, and intestines are the rational indications to guide us in the choice of remedies. If called in the early stage of the disease, in all the milder cases a single powder—containing from 15 to 8 grains of Dover's powder, 3 grains of calomel, and 3 grains of pulverized gum-camphor—given at bedtime and followed in the morning by a saline laxative sufficient to produce two or three intestinal evacuations has very generally relieved all the more important symptoms; and by giving 3 grains of quinine sulphate three times a day for three or four days the convalescence has been complete.

Sulphate of quinine strongly recommended in the treatment of influenza. Large doses should be administered in accordance with the age and temperament of the patient and the severity of the attack. Gellé (Jour. de Méd. de Bordeaux, Mar. 9, '90).

Best results obtained from diaphoresis followed by quinine. Combination of pilocarpine and morphine found to act better than antipyrine:—

℞ Pilocarpine hydrochlorate, $^1/_2$ grain.
Morphine sulphate, $^1/_3$ grain.
Water, 3 ounces.

M. Sig.: A teaspoonful every fifteen minutes, by mouth. Wood (University Med. Mag., Mar., '90).

At the outset of an epidemic every member of his battalion given 4 1/2 grains of sulphate of quinine daily, and manœuvres in the open air forbidden. This was continued for twelve days. While the epidemic spread in the immediate vicinity of the barracks, few of the soldiers were affected. Similar good results, however, were not had when the disease already existed. Then antipyrine rendered the greatest service. Tranjen (Berl. klin. Woch., Feb. 17, '90).

Quinine sulphate has no apparent effect in modifying the course of an uncomplicated attack of influenza. Thompson (Va. Med. Monthly, Aug., '91).

Quinine has a decided effect in relieving the neuralgic symptoms. Ingals (Jour. Amer. Med. Assoc., Oct. 10, '91).

Quinine believed to have a specific action in influenza. Fractional doses must not be given, but one massive dose for the entire day, preferably in solution. Graeser (Deutsche med. Woch., No. 51, '93).

Rabbits inoculated with blood of influenza patients, pure cultures of microbe, and with blood and cultures obtained from inoculated animals, and then with solution of quinine. Results showing controlling action of quinine. Mossé (Revue de Méd., Mar. 1, '95).

Quinine not completely excreted from tissues for some days; 3 to 5 grains in an effervescing saline draught every three or four hours controls the course of influenza. Large doses unnecessary; they produce marked cardiac depression, particularly in elderly people. Marsh (Lancet, Mar. 9, '95).

Quinine given at proper time and in large enough doses will prevent an outbreak of the disease. Given to one of five squadrons of cavalry, 7 1/2 grains daily. Only 7 men in squadron contracted influenza; in other four squadrons 22, 19, 32, and 42 cases, respectively, suffered. Graeser (Inter. klin. Rund., Nov. 10, '95).

Quinine an almost unexceptionable preventive of influenza: 5 grains immediately after breakfast during prevalence of epidemic. Sinclair Coghill (Brit. Med. Jour., Apr. 6, '95).

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Internal administration of carbolic acid recommended in cases of a mild, iregular type of influenza. After an experience of three hundred cases the writer pronounces it very efficacious. The dose given was a teaspoonful of a 1-per-cent. solution for a child of 5 years, administered every two hours until decided improvement was noticed, and afterward at longer intervals. S. H. Dessau (Med. Rec., Sept. 12, '96).

Calomel is an exceedingly useful drug in the early stages of an attack of influenza. The dose to be given amounts to 2 grains twice a day to adults, or 1 grain three or four times a day. In infants smaller doses are given, according to age. Cure can usually be produced by the third day. Frudenthal (Therap. Monat., Oct., '97).

Treatment is mostly symptomatic. In the beginning calomel in doses of from 2 to 5 grains for adults (one-tenth that amount for children) should be given. The calomel is divided into three powders, given at intervals of an hour. As long as the fever lasts, rest and a fever diet are indicated. Salipyrin, 15 grains every evening, and in the morning half that amount, to be given. With this remedy almost phenomenal results are obtained. Salipyrin must be continued for some time in order to achieve a good result. Ten grains prescribed at night for from three to five days after the fever has disappeared. Even after the temperature has fallen to the normal the patient should be confined to his room for a number of days. Bekess (Wiener med. Presse, Aug. 15, '97).

Kryofin used as an antipyretic in sixteen cases of influenza. It prevents a rise of temperature instead of reducing a temperature already elevated. Seven grains and a half may be given daily. Bresler (Ther. Monat., Oct., '97; Brit. Med. Jour., Nov. 27, '97).

The pressing indication to be met in asthenic patients lies in the state of their forces, which need sustenance. Stimulating remedies should occupy the first

place. Thus, alcoholic liquors, diffusible stimulants, and tonics should be made the basis of medication. The salts of quinine, selected and administered with judgment, will not only control many of the pains of the disease, but will relieve the weakness and stimulate the patient. Landouzy (La Presse Méd., Jan. 29, '98).

The following combination highly recommended for influenza ushered in by severe fever and nervous disturbances:—

℞ Quin. salicyl., 3 grains.
Phenacetin, 2 grains.
Camphor, $^1/_3$ grain.—M.

The above dose to be administered up to six times in twenty-four hours. Baccelli (Gaz. degli Osp. e delle Clin., No. 43, '98).

In the more severe cases, instead of one powder at bed-time, the same should be given every four hours until four have been taken, then move the bowels with the laxative and follow with moderate doses of quinine, alternated with 5-grain doses of sodium salicylate, until all the active symptoms have disappeared. When the bronchial symptoms have been persistent, with soreness in the chest, instead of the sodium salicylate I have given, with very good results, a teaspoonful of the following mixture every four or six hours until the chest symptoms were relieved:—

℞ Hydrochlorate of ammonia, $3^1/_2$ drachms.
Ant. et potass. tart., 2 grains.
Mercuric bichloride, 2 grains.
Morph. sulph., 3 grains.
Syr. of licorice, 5 ounces.—M.

When the influenza has induced at the beginning so much irritation of the gastric and intestinal mucous membrane that the powders of Dover's powder and camphor cannot be retained, I have given instead $4^1/_2$-grain doses of salol aided by $1^1/_2$ or 3 grains of calomel at night for the first two days with entirely satisfactory results. Then smaller doses of the salol, alternated with very moderate doses of quinine, has been all the medication necessary to complete the recovery of the patient. In all cases, during the active stage the patient has been kept at rest, and, as far as practicable, in a well-ventilated, warm, but not overheated room.

In the exudative form of aural complications, when the pain is severe, local blood-letting in the temporal region, ice-bags behind or about the ear, and, in some cases, iodine locally to the mastoid, forms the treatment. Subsequently, if paracentesis cannot be performed, warm instillations into the external auditory canal to be made hourly. If the pain increases and the temperature rises while exudation is detected in the middle ear, with pain and sensitiveness in the mastoid region, paracentesis affords the greatest relief. Inflation to be practiced, the canal syringed with an antiseptic solution and packed with gauze. Haug (Münch. med. Woch., Feb. 25, '90).

Faradic brush recommended in treatment of the neuralgias of influenza. The painful nerve is included between the two buttons of a brush especially constructed for the purpose, or between two ordinary wire brushes, kept stabile, and a faradic current, at first weak, but gradually increased in intensity. The application lasts from half a minute to two minutes. From eight to thirty *séances* are necessary. Nothnagel (Zeit. f. klin. Med., vol. xvii, Nos. 3, 4, '90).

Rapid relief obtained from the headache and the general nervous and digestive symptoms from the employment of copper arsenic in doses of $^1/_{100}$ grain. Johnson (Med. Summary, June, '91).

Salicin, 20 to 40 grains prescribed every hour, for three or six hours; then, every two hours, for a day; after that, at long intervals. Convalescence commenced in twenty-four hours in all cases, and, in most, in twelve hours. There were no serious complications. Maclagen (Lancet, Jan. 11, '90).

Administration of large doses of sali-

cin, 20 grains every hour, advocated. Turner (Lancet, July 18, '91).

Of all antineuralgic remedies tried, salophen proved the most useful. Separates into salicylate of soda and acetylparamidophenol in alkaline contents of the small intestine; odorless and tasteless. Hennig (Münch med. Woch., Sept. 3, '95).

Salicylate of soda, 2 or 3 grains every three hours to older children. Maltine with coca-wine for neurasthenic conditions. W. L. Stowell (Arch. of Ped., Oct., '95).

Twenty cases of influenza attended with neuralgic pains greatly ameliorated by 15 to 30 grains of salophen. Recovery within two days. Salophen embodies advantages of salicylate of soda without possessing its disadvantages. Claus (Med. Bull., May, '95).

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No drug has given more favorable results in the treatment of influenza than benzoate of soda. It may be given in capsule or powder form, the usual dose being 10 grains, three or four times a day. When muscular symptoms are pronounced, the following combination acts admirably:—

℞ Sodii benzoas, 2 drachms.
Salol, 1 drachm.
Phenacetin, 36 grains.

M. et ft. chart No. xij.

Sig.: One powder every four hours. Editorial (Amer. Med.-Surg. Bull., Nov. 25, '97).

For influenza in children salipyrin is an efficient remedy. For a child of five years the dose is 4 grains, and for one of ten years 8 grains, to be administered three times daily. Editorial (Med. News, Mar. 19, '98).

The pharyngitis and rhinitis, which are often the most troublesome symptoms of influenza in childhood, are treated by pulverizations. For this purpose a 2-per-cent. alcoholic solution of rectified turpentine is preferred. Furst (Rev. Mens. des Mal. de l'Enfance, Jan., '98).

Yerba santa prescribed in cases of cough supervening on influenza, with good results. Dose of fluid extract, 10 to 40 minims, combined with extract of malt, as malto-yerbine,—dose, 1 to 4 drachms. Joseph Westmorland (Lancet, Apr. 23, '98).

In only a very few instances has the fever temperature reached 104° F., and when it did it was readily reduced by free sponging of the surface or a few doses of aconite or veratrum viride. The diet should be light and carefully adjusted to the ability of the digestive organs to receive and appropriate it. When pneumonia or any other complicating disease supervenes, for which the practitioner should always be on the alert, it should be treated promptly and on the same principles as would govern its treatment under other circumstances.

For the cephalalgia and rachialgia a blister to the nucha recommended. The pulmonary hyperæmia may be relieved by a like application to the chest. Convalescence requires quinine. Peter (Le Bull. Méd., Jan. 19, '90).

Attention called to the usefulness of mustard, in the form of sinapisms, for the treatment of troublesome cough in influenza. Pavel M. Gorodtzoff (Wratsch, No. 32, '91).

Ammonium chloride found superior to quinine in the pulmonary form. Marotte (Gaz. Hebd. des Sci. Méd. de Bordeaux, June 21, '91).

Case of influenza which terminated in pneumonia. When fatal results were expected from the disease and collapse was threatened, the administration of strychnine and of inhalations of oxygen produced most remarkable results on two occasions. Gilchrist (Brit. Med. Jour., Feb. 13, '92).

Literature of '96-'97-'98.

In cases seen early, especially those presenting pleurodynia or pleuritic symptoms, the writer gives the following:—

℞ Salol, 3 grains.
Terpine hydrate, 3 grains.

Mix. In powder or capsule.

One powder or capsule is given every two, three, or four hours, according to the indications of the case, and this treatment is kept up for from twenty-four to thirty-six, or even forty-eight hours, according to the progress of the symptoms and of lesions, in case the pleura or lung be involved. In the latter case strychnine sulphate from $^1/_{100}$ to $^1/_{30}$ grain is combined with it. If cough is sufficiently troublesome to require sedatives, codeine, from $^1/_{24}$ grain to $^1/_{10}$ grain, is likewise added. S. Solis-Cohen (Phila. Polyclinic, Apr. 4, '96).

Literature of '96-'97-'98.

In multiple neuritis following influenza treatment should consist first in absolute rest in bed. Anodynes must be given in sufficient doses to relieve pain, when that is a prominent symptom. The antipyretic anodynes are insufficient in safe doses if the patient has pains for many days. Cinchonidine salicylate is distinctly valuable. At a later stage potassium iodide and mercuric chloride in small doses are helpful. When the pain is seated in an extremity, firm pressure with a flannel bandage yields great comfort. Blisters over the painful nerve-trunks when they are superficial are also valuable in relieving pain. Close watch must be kept on the action of the heart and the character of the breathing. In most of the fatal cases death results through paralysis of the diaphragm. The closest attention must be given throughout the course of the case to the nutrition of the patient and to the condition of the skin, especially over portions of the body exposed to pressure. As far as possible the stomach should be reserved for food. Allyn (Jour. Amer. Med. Assoc., July 24, '97).

A soldier was brought to the hospital suffering with severe influenza, which commenced with a violent chill and pain in the side. Bacteriological examination of the sputum showed the presence of numerous streptococci. Marmorek's serum injected—20 cubic centimetres (5 drachms) each time—and after four injections the temperature was reduced to normal. The patient recovered completely. Carrieu and Pelan (La Méd. Mod., Apr. 27, '98).

The foregoing outline of treatment of influenza is the result of my own observations during all the epidemics that have prevailed in this country since 1837. The only cases of threatened "heart-failure" that have been met with were in patients who were habitual drinkers of alcoholic liquors or had taken large doses of some one of the coal-tar antipyretics with brandy or whisky.

Antipyrine is of service in allaying the spasmodic cough of influenza associated with bronchial catarrh and, in some cases, with subacute bronchitis. E. T. Bruen (University Med. Mag., Jan., '89).

Subcutaneous injections of pilocarpine followed by excellent results. Pyrexia may be met by cold sponging, cold affusions, the cold pack, or the cold bath. Antipyrine, antifebrin, and kindred remedies largely used during epidemic, and rendered excellent service. Eichhorst (Corres. f. Schweizer Aerzte, Mar. 1, '90).

In the pains of influenza antipyrine is the analgesic *par excellence*. H. Reding (Med. Standard, Dec., '90).

In the painful form of influenza antipyrine and exalgin hold the first place. These failing, injections of morphine may be made. In the gastro-intestinal form, absolute rest in the recumbent posture should be maintained, and preparations of opium, of which paregoric is the best, administered. In the catarrhal form, quinine, 4 grains, morning and evening, should be given, alone or combined with antipyrine, 15 grains. Aconite is also useful in this variety. Stimulants may be required. Pulmonary complications call for cardiac tonic treatment:—

℞ Caffeinæ,
Sodii benzoatis, of each, 30 grains.
Aquæ bullientis, 1 $^1/_2$ drachms.

M. Sig.: Fifteen minims b. vel t. d., subcutaneously.

If possible convalescence should be spent in the country. Dujardin-Beaumetz (Bull. Gén. de Thér., Jan. 15, '90).

Mixture of antipyrine and salicylic

acid of value, to be followed by a pill containing iron and nux vomica. Bigelow (Med. Bull., May, '91).

Case in which acetanilid has been given in doses of 25, 15, and 10 grains, respectively, within twenty-four hours, with toxic effect: cyanosis, syncope, subnormal temperature, and excitement. Childs (Atlanta Med. and Surg. Jour., Feb. '91).

The depression following the acute attack of the disease is, in part, attributed to the administration of large doses of antipyrine, phenacetin, and antifebrin. Patton (Med. and Surg. Rep., May 23, '91).

Salipyrin has rendered excellent service in influenza. Argo (Ther. Monats., May, '92).

Phenacetin recommended in influenza in small and frequent doses. The drug does not cause gastric disturbances, it is prompt and decided in its action, it has no cumulative effects, and it is much safer for children and old people than is opium. P. O. Stimson (Med. and Surg. Rep., Nov. 21, '91).

Phenacetin warmly recommended in from 4 to 10 grains. The second dose is given an hour after the first, and repeated every four hours if the patient is not relieved. Clemow (Brit. Med. Jour., June 27, '91).

Use of antipyrine advised in influenza. Salipyrin and quinine also of service. De Renzi (La Clinica Moderna, Dec., '95).

Protests against reckless use of such drugs as salicin and antipyrine; relieve immediate symptoms, but tedious convalescence and cardiac debility encouraged. Quinine the true antitoxic in influenza. Burney Yeo (Lancet, Mar. 2, '95).

Concurrence with Burney Yeo and Moffatt, but patient should be alleviated by active measures. To do this and lower the temperature in influenza, 4- to 6-grain hourly doses (in cachets) of phenacetin valuable. Two more cachets at intervals of four hours, if necessary. J. H. Barnard (Lancet, Mar. 23, '95).

Diminished mortality and shortened period of convalescence of recent epidemics of influenza due to the fact that antipyrine and similar depressants are being withheld. Grant (Lancet, Mar. 2, '95).

Antikamnia is one of the best remedies in influenza. In doses of 3 to 10 grains it appears to act as a speedy and effective antipyretic and analgesic. The average dose is only 5 grains, which may be repeated without fear of unpleasant symptoms. T. D. Crothers (Quarterly Jour. of Inebriety, Jan., '94).

Literature of '96-'97-'98.

Phenacetin considered the safest and best remedy in influenza in the infant. As high as 5 grains at a dose has been given an infant eighteen months of age, with no depression. It was used in this case on account of a threatened convulsion, which passed away, and the child quieted down and went to sleep. Generally from $^1/_2$ to 2 grains should be given to children, with careful directions when to stop it. B. M. Smith (Ped., July 15, '97).

Salipyrin looked upon as almost a specific in influenza in childhood. At ages from five to ten years $4\,^1/_2$ grains are given thrice a day; from ten to fourteen years, 15 grains thrice a day. After a couple of days it will usually be sufficient to give only two doses a day. Furst (Rev. Mens. des Mal. de l'Enfance, Jan., '98).

Antipyrine is often harmful in the asthenic forms of epidemic influenza. Far preferable to quinine. L. Landouzy (La Presse Méd., No. 10, p. 57, '98).

Some of these have required the diligent and protracted use of strychnine, strophanthin, and other vasomotor tonics, with rest and fresh air, to secure a return to health.

Tincture of strophanthus, from 1 to 5 minims, with milk and cognac, recommended, and in grave cases inhalations of oxygen and subcutaneous injection of strychnine. Giovanni (L'Observatore, Torino, Jan. 25, '89).

The severe nervous prostration requires alcohol and quinine, and in bad cases even injections of caffeine and ether. In the neuralgic or rheumatoid

form of influenza, antipyrine, 15 grains, combined with the bicarbonate of sodium, 7.5 grains, is recommended every four hours. Iluchard (Revue Gén. de Clin. et de Thér., Dec. 12, '89).

In the treatment of the cardiac complications of influenza alcohol is of the first importance in cases of simple heart-failure. Caffeine citrate and cactus grandiflora proved next in value. Nitroglycerin appeared to act well in the aged and in gouty cases at any period of life, and strychnine was also of great service. Curtin and Watson (Inter. Med. Jour., Jan., '93).

Convalescence following influenza: Glycerophosphate of lime in form of wine, syrup, or capsules; remarkable results. Lafage (Le Bull. Méd., Mar. 27, '95).

Convalescence following influenza: Glycerophosphates of lime, iron, sodium, magnesium, and potassium, either by subcutaneous injection or by the mouth. Albert Robin (Bull. Gén. de Thér., May 15, 30, '95).

Literature of '96-'97-'98.

Strychnine arsenate or strychnine sulphate ($^1/_{128}$ grain) every hour or two, not more than eight or ten doses being given daily, admirably supports the nervous system, and therefore the heart. Editorial (Indian Lancet, May 16, '97).

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INGROWING TOE-NAIL. See NAILS, DISEASES OF.

INSANITY.

Definition.—Insanity means disordered mental function.

All disordered mental function is, however, not insanity; for example, the delirium of fever, of alcoholic or drug intoxication, although disordered mental function, is not, strictly speaking, insanity; still, the physical disorder upon which the febrile or toxic delirium depends does not differ so much from the underlying physical condition of insanity as may at first thought appear. The disorder of function in all cases is primarily due to a derangement of nutrition in the brain. This brings us to the fundamental fact that in order to have disordered function of the brain we must have either disordered nutrition or structural alteration of this organ.

At the present day this apparently materialistic conception must be accepted. As no mental or psychical manifestations can occur except through the medium of the brain, we may say outright that the brain is the organ of the mind, and any alteration in the structure or nutrition of the brain will affect favorably or unfavorably the functions of that organ. Upon this basis we may assume that without brain there can be no thought; and without healthy brain there can be no healthy thought.

The morbid physical basis of insanity is disordered nutrition of the brain in differing stages. It may be:—

1. Anæmia.
2. Hyperæmia.
3. Inflammation of the brain or meninges.
4. Toxic substances circulating in the blood (drug or bacterial poisons).
5. Gross lesions of brain-structure, such as tumors, apoplexies, abscesses, embolism with consecutive softening. These may be results of nutritive disturbances.
6. Interstitial hyperplasia of connective tissue, which is probably primarily inflammatory.
7. Primary structural alteration, hereditary or acquired.

Insanity must be conceived as a physical disease,—a disease of the brain. While it is customary to speak of mental disease, or of a psychosis, it is well understood that a disorder of the mind—or

psyche—having no relation to a physical substratum, the brain, is impossible.

Classification. — Basing mental disease upon these physical substrata, the usual symptomatic classification of insanity into mania, melancholia, and dementia appears about as rational as a division of kidney diseases into polyuria, anuria, and incontinence.

The first requisite for a logical study of insanity is, therefore, a rational classification,—one based upon the known pathology or pathogeny of the disease. The time for a perfect classification of this sort has not yet arrived; our knowledge is still too vague or incomplete; but in the following an attempt has been made which may have some merits as a working scheme.

In this classification there are seven classes or groups of mental disturbance, most of them clearly differentiated clinically, but all based upon pathology or pathogeny.

The groups are as follow:—

I. Psychoses due to imperfect development of the brain, which may be hereditary, congenital, or acquired. To this group belong idiocy and imbecility.

II. Psychoses due to vicious or abnormal brain-organization. These are always hereditary. To this group belong paranoia, circular and recurrent insanity. Some cases of hysteria and epilepsy may also be included.

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Causes of insanity investigated in the last 1014 patients admitted to the Bristol Lunatic Asylum, 507 being males and a like number females.

From the statistics obtained it would appear that all forms of insanity are strongly hereditary, the percentage being for all cases with a definite history of hereditary predisposition 28.7 per cent., and with a strongly neurotic history 4.1 per cent.: total, 32.8 per cent.

That of all forms the congenital hold the first place with 44.4 per cent. Puerperal insanity seems to be the next most hereditary form, with 33.3 per cent. hereditary predisposition, and 7 per cent. with neurotic history, these percentages having regard to female cases only. Then follow the ordinary cases, with 29.7 hereditarily predisposed and 4.9 with a history of neurosis; 23 per cent. in general paralysis, 21.5 per cent. in epilepsy. J. R. Blachford (Jour. of Mental Science, July, '98).

The simulated paranoia of chronic alcoholism belongs to a different group (Group VI).

III. Psychoses due to simple disturbance of nutrition in the brain, such as anæmia and hyperæmia. To this group belong the majority of cases of melancholia (depression) and mania (exaltation). In many cases the diagnosis "melancholia" and "mania" are incorrect, a transitory depression or exaltation being regarded as the essential clinical manifestation.

IV. Psychoses due to microscopical structural alterations in the brain. These are primarily probably nutritional or toxic.

In this class are included general paresis, catatonia, consecutive dementia, senile dementia, and epileptic dementia.

In a majority of the brains of those dying insane, macroscopical examination shows a milky opacity of the arachnopia, closely associated with underlying morbid processes in a space which can be covered with the two hands placed together, the lower ends of the hypothenar eminences covering the spot where the fissures of Rolando meet. The giant pyramids are the first to show markedly-altered structure. J. B. Tuke (Edinburgh Med. Jour., Feb. to June, '94).

The doctrine of the neuron and the interrelation of neurons within the central nervous system affords a foundation for possibilities in nerve-activity. The cortical areas are themselves complex

structures, yet in each cluster the individual neuron preserves not only its integrity as distinct from other neurons, but also its threefold character as a nutritive and dynamic doubly-connected apparatus. The human brain shows four layers: (1) the molecular layer; (2) the ambiguous layer; (3) long pyramidal layer; (4) mixed pyramidal or polymorphic layer, including Meynert's layer, *plus* spindle layers. Alteration and destruction of fine naked collaterals and nerve-terminals shown to exist in the molecular layer and swelling and softening of minute protoplasm-granules attached to special processes in the superficial layer of the cortex. Lloyd Andriezen (Brain, P. 68, p. 549, '95).

Possibility of there being no non-medullated nerve-fibers in the cerebral cortex. Naked axis-cylinders ought to be a physiological impossibility in cerebrum; their presence could only give rise to irregular overflow of energy, with corresponding confusion. It is probably through protoplasmic processes in lateral buds or gemmules that the axons influence protoplasm of dendrons and cells. Their uncovered endings come into close contiguity with gemmules. The gemmules that are specially liable to injury from toxic or morbid influences are the first portions of the neuron to atrophy and disappear in certain diseases. H. J. Berkley (Medical News, Nov. 9, '95).

Changes as given by Lloyd Andriezen explain the diminished sensitiveness of an alcoholic subject to impressions from without, and also the general loss of memory and lack of association of ideas. Microscopical examination cannot give us all the information we desire when the initial cause is not known. The conviction is steadily growing that actual agents which produce tissue-changes are chemico-toxic, absorbed or ingested, produced by altered tissue-metabolism or elaborated by bacteria. Dercum (Jour. Amer. Med. Assoc., July 15, '95).

Literature of '96-'97-'98.

The presence of micro-organisms in the cerebro-spinal fluid and cortex involve their pre-existence in some other part of the organism, and their presence during the course of acute mental disturbances is not relational or causative, but associative. H. A. Tomlinson (Northwestern Lancet, Sept. 1, '97).

V. Psychoses due to gross lesions in the brain. To this class belong syphilitic insanity, post-apoplectic insanity, insanity from tumors and abscesses, and insanity from cranial traumatisms.

VI. Psychoses due to toxic substances circulating in the brain. In this class are included acute confusional insanity, puerperal insanity; alcoholic, plumbic, and other chronic drug intoxications; uræmic insanity, post-febrile and most cases of post-operative insanity, and insolational insanity.

A form of insanity combined with multiple neuritis is the result of blood-poisoning, which affects the whole nervous system, especially the peripheral nerves. Ireland (Jour. of Mental Science, July, '90).

Specific infection must be included among the causes of mental symptoms. Analogies with nervous affections known to be of microbic origin favor the view that insanities with similar or related phenomena or lesions are also microbic in origin. Mental disorders of pregnancy and puerperal state are probably in a considerable portion of cases toxæmic. C. K. Mills (Amer. Jour. Med. Sci., Nov., '94).

It is of comparatively rare occurrence for actual insanity to develop during course of bodily disease. When the cause is not continuous,—such as poisons, fevers, and traumata,—mental symptoms, in the great majority of cases, disappear; in heart disease and phthisis they may disappear and reappear from time to time: in some cases, such as insanity connected with gouty kidney, they only disappear with death. Reynolds (Brit. Med. Jour., Sept. 28, '95).

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Tuberculosis is not believed to be a cause of insanity, but the results of tuberculosis in any of their forms—in

other words, tuberculous dyscrasia of any kind—is, just as any other dyscrasia, one of the causes of disease of the mind, or insanity. Ales Hrdlicka (Al Shifa, Jan., '96).

Conclusions as to the possible relation of intestinal autointoxication to mental disturbance: 1. Urines rich in indican contain very little or no preformed sulphuric acid, and are toxic. 2. When the sulphate ratio is materially changed, it is likely to indicate autotoxis in connection with an increase in the amount of combined or ethereal sulphates. 3. Such indications are generally found with acute insanities, in which rapidly developing symptoms occur. 4. Fugacious and changing illusions and hallucinations, unsystematized delusions, confusion, and verbigeration in connection with insomnia, pallor, intestinal indigestion, constipation, and rapid exhaustion, are due to autotoxis. 5. Paranoiac states, or those in which concepts are the features; chronic stuporous conditions, and certain forms of dementia have little to do with the formation of intestinal products of putrefaction. 6. Various post-febrile, traumatic, alcoholic, or drug insanities are those in which autotoxis is most constant. 7. The variations in the excretion of combined sulphates keep pace with the changes in the progress of an established insanity, acnes and epileptoid attacks being directly connected with the putrefactive processes. 8. The most successful treatment consists in lavage; intestinal douches; gastric and intestinal antisepsis by means of hydrochloric acid, borax, sodium salicylate, charcoal, guaiacol, or naphthalin in small, repeated doses; and the administration of a combination of the red marrow from the small bones, blood, and glycerin. A. McL. Hamilton (N. Y. Med. Jour., Nov. 14, '96).

VII. Psychoses due to developmental changes in the brain, nutritive or structural. In this class are placed pubescent and climacteric insanity. It may be questioned whether these forms of insanity are due to developmental changes in the brain, but the general similarity in character of the symptoms coincident with the period of puberty or of the menopause justifies the assumption of such changes, even in the absence of direct demonstration.

Symptoms.—The symptoms of insanity may be divided into physical and psychical or mental. The former are referable to the circulatory, digestive, secretory, genito-urinary, and nervous systems. The general nutrition of the body is frequently defective. Chapin states that "90 per cent. of the admissions to the hospitals present the condition and appearance of some form of bodily ill-health."

> The source of mental diseases is not only in the brain itself, but in all the organs. For this reason no pathological changes are found in the brain in many mental diseases, and when, with time, they do appear, they are consecutive, but not primary. In examining and diagnosing the psychical condition of a man, one must closely and minutely examine the whole organism, and not omit any change in any organ, though seemingly insignificant, since experience teaches that very serious changes in the function of the brain arise from insignificant changes either in the nerves or in other organs. Ladislas Kohlberger (Przeglad Lekarski, Nos. 25 and 26, '93).

Anæmia is extremely frequent, especially in states of depression and mental confusion. In the large majority of cases of acute insanity careful inquiry will develop the fact that preceding the attack there was progressive loss of weight.

Depression of the circulation, weakened heart-action, and an apparent lack of vascular tonus are frequent. They are most notable in melancholia, general paresis, and consecutive dementia. Vasomotor spasm is often present in paranoia, combined with oppression of breathing, and a sense of great anxiety.

> In a study of the blood in the insane the hæmoglobin percentage was always below normal. In melancholia this per-

centage averaged 69.7; in epilepsy, 62.92; in general paralysis, 68.75; and in secondary dementia, 53.75.

The most marked diminution in the number of red corpuscles occurred in the cases of dementia, the average being 4,070,000 per cubic millimetre. The next in order were the epileptics, who presented a corpuscular strength of 4,520,800. The cases of general paralysis gave a count of 4,700,250. W. Johnson Smith (Jour. of Mental Sci., Oct., '90).

Examination of fourteen cases with reference to leucocytes. In cases of senile dementia there is an increase; in general paralysis, marked decrease; in cases with tendency to maniacal excitement, great increase. Burton (Amer. Jour. of Insanity, Apr., '95).

Toxicity of blood-serum, in cases of mental disease, found to be as follows: In paranoia it resembles most nearly the normal; in lypemania it is less toxic; in dementia it is always diminished; in general paresis it is increased, as also in acute mania. In epilepsy, imbecility, idiocy, and "moral insanity" the toxicity is normal or diminished. D'Abundo (Jour. de Méd., Feb. 12, '93).

Death of a rabbit induced by the intravenous injection of 15 minims of serum from a healthy man per $3\frac{1}{4}$ ounces of the animal's weight. The toxic action of the serum of the insane was augmented when the state of excitation existed, and diminished when the condition was one of depression, dementia, or idiocy. Rummo and Bordini ("Rev. Sper. di Fren. e di Med. Legale in Relazione con l'Antrop. e le Sci. Giur. e Soc.," Reggio-Emilia, '93).

The wide-spread degeneration of the arterial system, commonly found in the insane, plays a very important part in the pathogenesis of mental aberration. Beadles (Jour. of Mental Science, Jan., '95).

In clearly established cases of insanity there is a considerable increase in the average frequency of the pulse, both among men and among women. Average from 2172 cases, 84.8 in women and 80.8 in men. Abnormal tracings are found at some stage of the disease in a vast majority of cases. Th. H. Kellogg (N. Y. Med. Jour., July 6, '95).

Examination of the post-mortem records of the Dalldorf Asylum in Berlin. Heart-lesions found present in males in 61.67 per cent. and in females in 42.75 per cent. In the sane, according to the records of the Erlangen Pathological Institute, the proportion of heart-lesions is 27 per cent. for males and 23.2 per cent. for females. Valvular lesions are most frequent. C. Strecker (Schmidt's Jahrbücher, Sept. 15, '94).

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Diseases of the heart may become the exciting cause of the insanity in predisposed persons. The different symptoms which accompany such disorders, such as pain in the præcordial region, palpitation, exaggerated heart-sounds, feelings of constriction, difficulty of breathing, headache, and giddiness, may all, by causing derangements of sensation and illusions of the senses, become the starting-points of insanity.

Deficiencies of the heart's action may lead to mental affections in persons not predisposed, partly by deranging the circulation of blood in the brain, and partly by altering the chemical action of the blood. The mental disorders thus caused generally take the form of mania hallucinatoria; confusional insanity, with hallucinations. The hallucinations take their color from the abnormal organic feelings.

If the heart disease goes on without alleviation or betterment, the hallucinatory derangement may pass into dementia. Jacob Fischer (Allge. Zeit. f. Psych., B. 54, H. 6, '98).

Fever is not rare in acute states. It is most frequent in states of mental confusion and exaltation, but may also be present in depressive states. Fever is usually a symptom of grave significance and should always lead to a careful physical examination. It may signify a meningitis, a visceral inflammation, or an essential fever.

Observations on the daily oscillations of temperature in functional psychoses. In passive melancholia the temperature is generally diminished. The evening rise is not very pronounced. The same is true of agitated melancholia. In mania there is a rise of 4.5° to 9° F. during the height of the disease. In paranoia the temperature-curve is normal. In stupor it is below normal. Hysterical psychoses show irregular oscillations. In general paresis and dementia the temperature is sometimes much below normal. Th. Ziehen (Deut. med.-Zeit., Aug. 23, '94).

Among the prominent symptoms referable to the digestive system is anorexia, often leading to absolute refusal of food. This is frequently due to gastro-intestinal disorders, but in many cases the refusal of food is the consequence of hallucinations or delusions. The patient has a fear of food (sitiophobia), either because he thinks the food will not be digested, or that there is obstruction of the bowels, or total absence or decay of the abdominal viscera, or because he is afraid of being poisoned. The fear of poisoning, due to hallucinations of taste is a frequent symptom of paranoia. Delusions of obstruction or absence of abdominal viscera are often present in melancholia. Want of appetite is also sometimes an expression of the extreme indifference to all subjective sensations or objective impressions in advanced dementia.

In maniacal states there is often an abnormal desire for food. This may alternate with absolute anorexia.

Of 169 cases of visceral diseases, 87 suffered at one time or another from referred pain associated with superficial tenderness. Mental disturbance seemed to stand in direct relation to the intensity of pain. Depression seemed to be associated mainly with the presence of areas over lower part of chest and over the abdomen. Hallucinations are only present where scalp-tenderness is a marked feature of the sensory disturbance. Henry Head (Brit. Med. Jour., Sept. 28, '95).

Gall-stones found to be twice as frequent in the insane as they are stated to be in the sane. Snell (Brit. Med. Jour., Aug. 12, 19, '93).

Literature of '96-'97-'98.

Malignant disease is a well-recognized cause of refusal of food by an insane patient, but less attention appears to have been given to gastritis, a common disorder among the sane, and assuredly more so among the insane. Gastritis appears in some cases to be the most probable cause of food-refusal. Many of these cases would, no doubt, recover by simple feeding, but, even in these, lavage before feeding would probably hasten recovery. H. Harold Greenwood (Jour. Mental Science, Jan., '98).

Persistent constipation is frequent in melancholia. Diarrhœa is comparatively rare. In many acute forms of mania and melancholia, and in the early stages of general paresis, the patient passes fæces into his clothing or the bed. This is not always due to loss of control of the sphincters, but is sometimes intentional. In advanced dementia, paretic or consecutive, the loss of sphincteric control is usually paralytic.

The perspiratory secretion is usually diminished in melancholia. In mania salivation is often present.

Manifestations on the part of the genito-urinary system are frequent in insanity. In maniacal conditions there is sometimes polyuria. Incontinence is frequent in acute mania and in dementia. Involuntary passage of urine often occurs during epileptic attacks. Sometimes the urine is retained owing to indifference, while its retention may be due to a delusion, as in the case of a doctor mentioned by Chapin, who retained his urine day after day "lest its discharge might endanger the building and human life."

Results of inquiry into the relations of acetone, sugar, and albumin in the urine of insane patients suffering from diarrhœa due to degeneration of the solar plexus. In ordinary intestinal catarrh none of the above are present; but in diarrhœa due to degeneration of the solar plexus sometimes sugar, sometimes albumin, and sometimes both were found. This may aid in diagnosis in some cases. Cristiani (Jour. de Méd., Feb. 12, '93).

In 1700 cases albumin with renal tube-casts detected in urine of more than one-half of the cases of chronic insanity; 25 per cent. presented clinical evidences sufficient to enable any competent practitioner to make a diagnosis of kidney disease. In 75 per cent. of 200 cases the kidneys, examined post-mortem, showed pathological changes. Bondurant (Amer. Jour. of Insanity, July, '95).

Of 150 post-mortem examinations in insanity, 106 cases of chronic renal disease, or 70.6 per cent., found. Beadles (Jour. Mental Science, Jan., '95).

Of 154 post-mortem cases of insanity, 74 of renal disease, or 48 per cent., found. C. H. Bond (Brit. Med. Jour., Mar. 2, '95).

Of 532 post-mortems in cases of insanity, 327 cases of chronic renal disease, or 61.466 per cent., found. Bristowe (Brit. Med. Jour., Mar. 2, '95).

Exaggerated sexual desire is frequent in mania, and the early stages of general paresis, leading to venereal excesses, but oftener to masturbation. The most shameless acts of exposure and solicitation are seen in females, although masturbation is probably more frequent in males. In depressive states, and in the advanced stages of general paresis, sexual desire and power are diminished. Desire sometimes persists when potency is absent.

Sexual perversion is a symptom that may accompany any neurosis or psychosis, and should not be considered as a distinct affection, but as a part of the general symptomatology of insanity. Behr (St. Petersburger med. Woch., Apr. 4, '92).

In acute psychoses menstruation is nearly always arrested. It is said that one of the earliest signs of improvement in acute insanity in women is a return of the menstrual flow.

Conclusions based on a study of the menstrual function in the insane:—

I. There is no entirely regular menstrual history, if a number of years be taken into account, and that periods falling in from between three and five weeks are to be considered normal.

II. Normal menstruation is an expression of the general condition, and its suppression is often only an indication of the needs of the system, and so is a conservative act of nature.

III. In the chronic insane the menopause makes no radical change in the form of disease.

IV. In acute cases menstruation returns with regained general health, and is an indication that the system can again sustain the loss of force. It is always to be regretted when there is not, at the same time, increased mental vigor.

V. Tonics and general measures are, as a rule, preferable to direct or local treatment, though sometimes both are valuable.

VI. The underlying conditions which cause irregularities of menstruation are oftener the cause of mental disease than those deviations *per se*. Bissell (Northwestern Lancet, Apr. 15, '92).

Of 99 cases of chronic insanity, menstruation, on the whole, regular; irregularity occurred in patients generally over 35. Climacteric appeared, on the whole, earlier. Menstruation had influence almost certainly in 16 or 18 cases, questionably in 18. Erotism rare. Menstrual period seems to exert an actual influence, principally when the pain arising from some genital trouble reacts on the system. Naecke ("Influence of Menstruation on Chronic Psychoses," '95).

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The menstrual function in the insane differs in no essential respect from the same process in healthy women, and its influence upon the psychical condition is

slight and variable. Nache (Archiv f. Psychiatrie, Feb. 18, '98).

Among the nervous phenomena of insanity the most frequent is insomnia. This is sometimes very persistent in mania and general paresis. In the latter and in confusional states it rapidly leads to exhaustion. An occasional symptom of general paresis is a great tendency to sleep.

Headache is a symptom in general paresis, cerebral syphilis, and in melancholia. In the latter occipital cephalalgia is said by some observers to be diagnostic. Headache, more or less intense, also attends most cases of mental disturbance depending upon gross lesions in the brain.

Convulsions are present in epilepsy, uræmic insanity, general paresis, and syphilitic insanity. The convulsions in general paresis and syphilitic insanity are not typical epileptic seizures, but of the character described as epileptiform. They also occur at times in alcoholic insanity. The epileptiform attacks of general paresis are usually followed by a comatose or paralytic state lasting several hours or days. In some cases Cheyne-Stokes respiration may be present and still the patient recover from the attack. These apoplectiform seizures also follow true epileptic convulsions at times.

Fixed and irregular pupils or irregularity in the pupillary reaction is frequent in general paresis.

Tremor is present in alcoholic insanity and in certain forms of mental disturbance complicating cerebro-spinal diseases. The fibrillary tremor of the tongue and facial muscles in general paresis is diagnostic in many cases.

The tendon-reflexes are affected (usually diminished) in general paresis, alcoholic insanity, and the mental disturbances of peripheral neuritis. In some forms of melancholia the knee-jerk is increased.

The speech is early affected in general paresis. The scanning speech of the paretic is characteristic. In dementia the speech is often indistinct or slurring.

Certain trophic disturbances may also be looked upon as physical symptoms of insanity. Thus, the peculiar deformity of the ear termed "othæmatoma," or "the insane ear," is almost limited to insane persons.

Bilateral hæmatoma of the lobule may occur as the result of traction (violence) on these parts. (Archives of Otology, July, '94.)

There is strong evidence in favor of the contention that the proclivity of the insane to othæmatoma is due to a peculiar degeneration in the cartilage of the ear. This change is brought about by the same abnormal nutritional state which induces lesions of scalp, skull, and dura mater, to which the insane are specially prone. Middlemass and Robinson (Edinburgh Med. Jour., Dec., '94).

Comparative study of 200 sane and 200 insane men in reference to the development of the mammary gland, in which it is shown that hypertrophy of this organ (gynæcomastia) is from seven to eight times more frequent in the insane. Canger (Revue Inter. de Bibliog., Apr. 25, '93).

Absence of overlapping of the anterior portion of the upper dental arcades over the lower is a stigma of degeneration. Camuset (Annales Médico-psychol., Nov., '94).

In considerable number of insane women asymmetrical conditions of bilaterally-associated muscles observed, especially of the face.

In 411 insane females, excluding general paralytics, inequality of pupils was found in 25 per cent. In 396 chronic cases, except general paralytics, 35 per cent. had inequality of pupils. In 306 recent cases the tongue, when protruded, was deflected from the middle line in 24 per cent. In a number of cases the muscles of expression were more or less

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

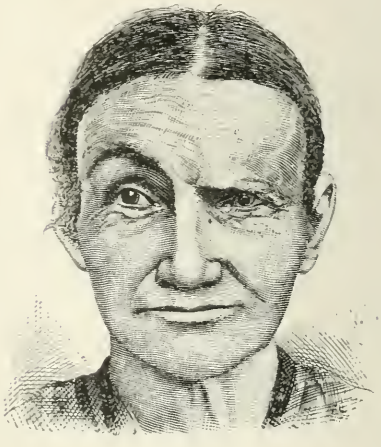

Fig. 6.

Asymmetrical conditions met with in the faces of the insane. (*Turner.*)

paralyzed on one side. J. Turner (Jour. of Mental Sci., Apr., '92).

DESCRIPTION OF PLATE.—Fig. 1. Asymmetry of expression in the lower part of the face in the case of an imbecile. Fig. 2. A case of acute melancholia with visceral delusions. Fig. 3. Asymmetry in the forehead, assumed with certain emotional states, in a young phthisical woman. Fig. 4. Another instance of asymmetry in the forehead in a case of melancholia. Fig. 5. A case of acute melancholia. Fig. 6. Asymmetry of the forehead in a case of chronic insanity. (Turner.)

There is no relation between physical and moral deformities. Individuals who, from a moral point of view, are depraved may be regular physically and *vice versâ*. Legrain (Le Presse Méd., Dec. 21, '95).

What may be accepted as a type of the criminal, the insane, epileptic, or neurotic man has not yet been discovered. Such a man bears marks showing simply that he belongs to a somewhat handicapped family. All modern studies

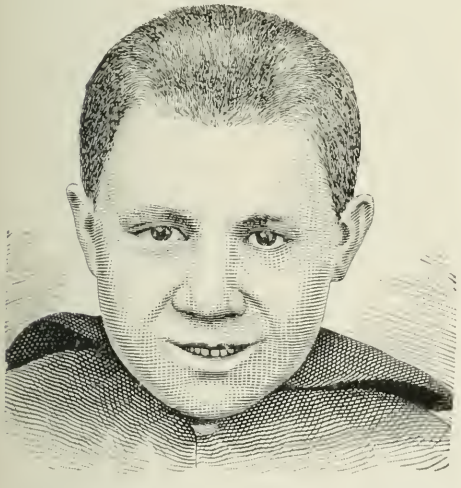

Fig. 1.—Features of degenerated individual. Physical conformation regular, and morally a perfect monster. (*Legrain.*)

seem to show that a man must be more than ever careful of his education, his training, and surroundings, using all possible moral and spiritual agencies to overcome his defects and make his powers more stable. Ch. Dana (Medical Record, Dec. 15, '94).

Special type marked by precocious dementia, patients exhibiting signs of degeneration at age of 17 to 20. Malschin (Neurol. Centralb., No. 3, '95).

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One hundred and eight insane patients examined with regard to the shape, size, and innervation of the uvula, the total

Fig. 2.—Features of degenerated individual. Deformed physically, and morally an inoffensive simpleton. (*Legrain.*)

number of deformities found to be 53, or almost 50 per cent. The commonest peculiarity was a twist to one side, about equally to the right or to the left, but a little oftener to the left side. The total number of patients with a twisted uvula was 32. The proportion was much greater in the degenerative forms of insanity, the number being 19 among 35 cases, or over half, as against 13 in 69 cases of acquired insanity. Thus, just in proportion as the physical stigmata of degeneracy were more marked the proportion of deformed uvulas increased. Bifid uvula was not found in any case. Charles L. Dana (Amer. Jour. of Insanity, Apr., '96).

Not only is there a greater want of symmetry in the outline of the cranium

in the insane, but the cranial bones vary much in their thickness, the alteration taking place being most frequently an hypertrophy of the bones. In 234 post-mortems performed by the writer (144 males, 90 females), the calvaria were distinctly thickened in fifty-one cases (22 males, 29 females). C. F. Beadles (Edinburgh Med. Jour., vol. xlv, No. 513).

As to whether thickened skulls cause mental aberration, personal view expressed that flattening of one side of the skull, obliteration of the sutures, and other irregularities are the precursors of affections of the brain; and that the Pacchionian bodies when enlarged may cause cerebral disturbances. J. F. Briscoe (Jour. Mental Science, Apr., '98).

Defective mental condition is associated usually, especially in the congenital class of cases, with certain physical characteristics, such as a defective hand, deformed palate, wandering eye, a want of co-ordinating power of the body and limbs, and inertness or too great restlessness. F. Beach (Treatment, Oct. 13, '98).

Bed-sores develop with great rapidity in the insane, especially general paretics and epileptics. A peculiar fragility of the long bones has also been noted.

In chronic disease of the central nervous system, especially in insanity, the ribs are apt to undergo very considerable morbid changes, which give rise to increased brittleness, and hence predispose the bones to fracture from the slightest violence. Constantinovsky (Med. Chronicle, Oct., '90).

Statement denied that general paralysis of the insane is accompanied by a rarefaction of the osseous tissue, leading to the ready production of fracture and retarding healing of bones, when broken. Christian (La France Méd. et Paris Méd., Apr. 21, '93).

Five cases of osteomalacia in insane patients. These 5 cases were observed during a period of six years, in which time 1500 patients passed under personal observation. The patients were all women, varying in age from 37 to 66 years. None of these showed symptoms of general paralysis. Wagner (Deut. Woch. f. Gesundheitspflege, etc., No. 9, p. 113, '90).

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Personal belief that mollities ossium may arise from gross dietetic errors, that rickets is a disease of growth, and that mollities ossium is apparently a disease of decay. The pathological conditions of bones will explain the fragility of the ribs of the sane and of the insane.

Out of 7182 deaths in the insane-asylums of England and Wales, 13 resulted from diseases of joints and bones, and 11 from fractures or dislocations. In 1897, out of 6783 deaths, 15 resulted from diseases of joints and bones and 13 from dislocations and fractures. J. F. Briscoe (Jour. Mental Science, Apr., '98).

Psychical Symptoms.—Among these is emotional instability, the minor grades of which are especially noticeable in neurasthenic conditions and hysteria. In maniacal states, paranoia, and the early stages of general paresis, the emotional instability is much heightened. The patient is easily "upset"; slight irritants may cause violent outbreaks of anger or rage with destructive attacks.

In melancholia the emotional instability tends to react to painful impressions. The patient is easily moved to tears, or is subject to morbid anxiety, sorrow, or fears, so often present in neurasthenic states and depressive forms of insanity.

The distinctive psychical symptoms of insanity are sensory and intellectual disturbances. The former are termed hallucinations and illusions, and the latter delusions and impulses.

Hallucinations.—An hallucination is a false sense-perception having no objective basis. There may be hallucinations of the special senses: hearing, vision, smell, taste, or of common sensation. Auditory and visual hallucinations are especially frequent, and are often symp-

toms of dangerous forms of insanity. The patient hears some one call him opprobrious names as he walks along the street, or voices in the wall, the chimney, outside of the door annoy him. Sometimes the voice is an internal one and commands him to kill his persecutor or destroy the latter's property. Hallucinations of hearing are especially frequent in paranoia.

Visual hallucinations are less frequent than those of hearing. They are present in paranoia, mania, and epilepsy. One of the most dangerous visual hallucinations seems to be that of "seeing red." The suggestion of blood often leads to homicide.

Hallucinations of taste are found in paranoia and melancholia. In the former the patient "tastes poison" in the food and hence refuses to eat, unless he can get food secretly. The hallucinations of taste of the melancholiac are, perhaps, sometimes exaggerated perversions of taste due to digestive disturbances. The same may be said of the hallucinations of smell. Hallucinations of smell are not rare in paranoia, climacteric insanity, melancholia, and especially, according to Savage and Krafft-Ebing, in mental disturbances connected with ovarian and uterine disease.

The hallucinations of the various special senses are often associated. Thus, auditory and visual hallucinations and those of smell and taste are frequently combined. In one well-marked case of paranoia hallucinations of all the senses were present and caused the patient much mental suffering.

Hallucinations of common sensation often give rise to complaints of vermin crawling upon or burrowing in the skin. In some cases they are, doubtless, evolved from paræsthesiæ, being, in fact, illusions, and not hallucinations. Insane persons frequently tear off all clothing and go about in a nude state. This is often regarded as a desire to exhibit the nude body, but it is probable that the clothing is taken off on account of some sensory disturbance attributed to the clothing.

Illusions.—An illusion is a sense-perception having an objective basis, but falsely translated to the consciousness. It is a faulty conception of an actual sense-impression. For example, when an undefined noise is heard as spoken language; when a fog is taken for the smoke of a burning city; when the pressure of a closely-fitting collar gives the impression and causes the feeling of strangulation,—these are illusions.

Delusions.—Delusions are false conceptions and judgments. Wood's definition of a delusion—the best and clearest ever formulated—is: "A faulty belief concerning a subject capable of physical demonstration out of which the person cannot be reasoned by adequate methods for the time being."

According to this definition all faulty beliefs or false judgments are not delusions. A faulty belief may be a delusion in one person and not in another. It is largely a matter of education, or of environment. Thus, certain political views or religious beliefs held by large numbers of the people appear to others as delusions. Persons without a physical or mathematical education may believe that perpetual motion and squaring the circle are possible. Physicists and mathematicians know that they are not possible. The contrary belief is not a delusion, but simply ignorance. The prevalent belief among some communities in the North during the late war between the States, that all rebels had horns, was similarly ignorance and not a delusion,

although the writer knew persons who held the belief.

A difference is made between insane and sane hallucinations and delusions. The former are said to dominate the life and acts of the subject, while in the life and conduct of the latter the hallucinations and delusions are merely incidental. The distinction is an arbitrary and indefinite one.

> [Shakespeare had apparently a clear notion of the difference. In "Macbeth," in the dagger scene, the hallucination is evidently recognized by the chief actor as a false sense-impression, since he asks: "Art thou but a dagger of the mind, a false creation proceeding from the *heat-oppressed brain*?" In the banquet-scene, on the contrary, all doubt of the reality of the vision has ceased when he addresses Banquo's apparition as if there were no doubt of its real presence. GEORGE H. ROHE.]

Delusions are divided into expansive delusions, or delusions of grandeur; depressive delusions, or delusions of debasement; delusions of persecution, and religious and sexual delusions. The delusions of grandeur and of debasement are the fundamental varieties. The others are mere modifications of them. Persecutory, religious, and sexual delusions are based upon some delusion of exalted or debased personality. Thus an insane person regards himself as persecuted because he is the offspring of royalty, illegally kept out of his rightful sphere; another is the saviour of mankind, but, like the Son of God, he has come unto his own and his own have known him not; another has boundless sexual power, and can generate a higher and nobler class of beings, but his enemies destroy or fraudulently substitute some inferior being in the place of the paragon. In all these phases of delusive belief the grandiose character is maintained, and the idea of persecution is merely a further development thereof.

Delusions of grandeur are present in general paresis, in which disease they have long been regarded as characteristic. They are also an essential element in paranoia, in which persecutory delusions are an outgrowth of them. In melancholia, delusions of debasement are often characteristic. In mania delusions of grandeur are often transitory and varying; in general paresis they are extremely extravagant, and in paranoia they are fixed and in a sense logical.

> Case of systematic delirium of grandeur without noticeable lowering of the intellect. G. Baliet and Arnaud (Annales Médico-psychol., Mar., Apr., '95).

Delusions of debasement or unworthiness are common in melancholia; they are rare in paranoia.

Delusions of persecution are characteristic of paranoia. In this form of insanity they are closely connected with hallucinations of hearing, smell and taste; indeed, delusions in the majority of cases are outgrowths of hallucinations. Persecutory delusions are extremely dangerous symptoms. Under the influence of such delusions most of the acts of violence of the insane are committed.

Religious delusions are found in paranoia, epilepsy, and melancholia. In paranoia and epilepsy they are nearly always of an expansive character. The subject fancies himself or herself an exalted religious personage, and may even claim the attributes of the Diety. In other cases he or she holds communication with God, the Saviour, the Virgin Mary, or some prominent saint. In these persons hallucinations of hearing and vision are always present. The religious delusions of melancholia are usually permeated with a profound sense of unworthiness of the subject, while the para-

noiac is saturated, so to speak, with the sense of his own importance and power, and is always convinced that he is entitled to more honor than the world renders him; the melancholiac, on the other hand, constantly and loudly protests his utter unworthiness, his sinfulness, the impossibility of ever regaining the lost grace of God.

Sexual delusions of an expansive character are present in the early stages of general paresis, in mania, and in paranoia. In the latter they are combined usually with persecutory delusions. The persistent doubts of sexual power so often found in neurasthenics cannot be regarded as delusions.

Morbid Impulses. Impulsive Acts.—When an epileptic during an hallucinatory aura attacks another person, a paranoiac under the influence of his persecutory delusions commits murder, or a sexual pervert cohabits with animals or with dead bodies, the acts are said to be *impulsive*, and committed in obedience to an imperative impulse, conception, or idea. The Germans call these impulses "*Zwangsvorstellungen*," literally coercive conceptions. The French term is "*obsessions*." The numerous so-called monomanias and monophobias of authors belong to this class of symptoms. Thus suicidal and homicidal mania, dipsomania, pyromania, kleptomania, erotomania, onomatomania, are not special varieties of insanity, but the manias are merely coercive impulses, often irresistible.

An impulsive tendency to suicide does not constitute a special variety of insanity; it is merely a symptom of a depressive mental state. It is most frequently a symptom of melancholia, but may be present in other forms of mental disturbance.

General Diagnosis.—The differentiation of the individual forms of insanity is often difficult, but it is still more difficult at times to say with positiveness that a person under examination is sane or insane. This is largely due to the fact that there is no absolute standard of sanity. The outward expression of insanity of thought and feeling is manifested through conduct, but as there is no general standard of sane conduct, it is necessary to compare the conduct of the person in question with the conduct of the generality of persons living under the same environments or to compare the conduct of the subject with his own previous mode of life. The behavior of a thief, a tramp, a drunkard, or a prostitute is not approved by society, but the thief and his proscribed companions are not considered as insane, either by society in general or by each other. But if a clergyman becomes a thief; a millionaire, a tramp, an ascetic, a drunkard; or one who has hitherto been a model of womanly virtue a prostitute, there are grave reasons for suspecting the sanity of the person thus offending. The general diagnosis of insanity must take into account not only the subject's conduct at the time being, but his previous history and his environment. Specific details will be given in the consideration of the special forms of insanity

General Prognosis.—Contrary to common belief, insanity is curable in a considerable proportion of cases. If appropriate treatment is promptly instituted the recovery-rate of all cases should reach at least 40 per cent. If certain groups that are incurable, such as imbecility, paranoia, general paresis, and epileptic and other secondary dementias are excluded, the proportion of recoveries should be much larger. It is not unreasonable to expect recovery in 75 per

cent. of the psychoses due to nutritive disturbances or toxic conditions.

The prognosis of insanity in childhood is, on the whole, favorable if there is no neuropathic ancestry. If, however, the child shows evidences of psychopathic heredity, the prognosis is bad. Moreau de Tour (Annales d'Hyposologie et de Psych., Dec., '91).

Of 2176 insane persons admitted into the Eastern Michigan Asylum, 378, or 17.3 per cent., recovered without relapse; 91, or 4.1 per cent., recovered, relapsing one or more times; 256, or 11.1 per cent., were discharged improved, remaining at home without again resorting to the asylum; and 522, or 23.9 per cent., died. The low absolute-recovery rate is due to the fact that all sorts of cases in various stages of chronic insanity are admitted. E. A. Christian (Amer. Lancet, May, '94).

The insane succumb in but a small proportion to infectious disease as compared with the general population. Of 15,248 deaths in Italian asylums, 8.46 per cent. were due to tuberculosis, 4.16 per cent. to pneumonia, and 1.75 per cent. to typhoid fever. Of 307,477 deaths in the general population, 12.22 per cent. were from tuberculosis, 15.50 per cent. from pneumonia, and 2.95 per cent. from typhoid fever. Gucci (Centralb. f. Nervenheilkunde, etc., No. 26, '89).

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The influence of microbian diseases among the insane leads, in the majority of cases, when the subjects are young, to a more or less considerable amelioration of the mental condition. M. René Charon (Archives de Neurol., May, '96).

The majority of authors agree that the prognosis of insanity, complicated by "insane-ear," is sufficient evidence of its incurability, while a few contend that there are cases in which perfect recovery has taken place. Out of 7000 admissions to the Connecticut Hospital for the Insane there was only one case that developed hæmatoma aurium and remained well. L. P. Clark (Amer. Med.-Surg. Bull., Aug. 22, '96).

Decidedly hereditary cases of insanity are often the most curable, although there is more likelihood of a relapse than in those in which the hereditary tendency is absent.

It has been estimated that 63 per cent. of recoveries from insanity take place before the age of twenty-five, although the young are more subject to relapses. The menopause is another period of life at which recovery occurs in many cases; but the disease is usually of long duration, not ending until the cessation of the menstrual function is complete. Genuine climacteric insanity, however, is rare.

Acute forms of insanity in which recovery is especially apt to occur are stuporous insanity, or so-called primary dementia; confusional insanity; puerperal and lactation insanity; and that which follows acute physical disorders. But systematized delusional insanity belongs to the chronic class and is rarely curable. The secondary, or terminal, stage, dementia, as well as recurrent and alternating insanity, is hopelessly incurable.

General paralysis of the insane is almost inevitably fatal. Henry R. Stedman (Boston Med. and Surg. Jour., June 10, '97).

Generally one may say that if a child has an attack of mania, melancholia, or other mental affection, and there is no history of hereditary predisposition or masturbation, the prognosis will be favorable; on the other hand, if heredity is well marked and masturbation is much practiced, the prognosis will be bad, especially as regards the future. An exception must be made in the cases of juvenile dementia the result of hereditary syphilis, moral insanity, general paralysis, and usually by nymphomania and satyriasis. In these cases the prognosis is always bad. Fletcher Beach (Jour. Mental Science, July, '98).

General Principles of Treatment.—Inasmuch as insanity is here considered as purely physical disease, it is evident that purely psychical remedies occupy a very subordinate part in the treatment. They are limited to what may be called, in a general way, the management, or hand-

ling, of the patient. A tactful nurse—one who combines the *suaviter in modo* with the *fortiter in re*—is here essential. Agreeable surroundings and keeping at a distance sources of irritation may also be classed with the psychical remedies. Isolation is not to be recommended, especially in hallucinatory and delusional forms.

Regarding the much-discussed question of institutional or home treatment, the decision should in all cases be in favor of the former. It is, of course, assumed that the institution is up-to-date in all respects, and that the treatment is according to modern methods.

The general physical treatment consists in good food, rest in bed in acute cases, and out-door life after the acute stage is over and danger of exhaustion has passed.

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Systematic employment and training of the insane is the keystone to modern treatment of the insane. Edward D. O'Neill (Jour. of Mental Science, Apr., '96).

In the majority of cases it will be found that the digestive and assimilative functions require attention, and that restorative tonics are indicated.

Mental disease is usually attended with malnutrition, and in treating insanity the nutrition should be made as perfect as possible, and as soon as possible. A. R. Moulton (Amer. Jour. Insanity, Oct., '94).

Insomnia can generally be combated by baths, out-door life, attention to hours of feeding, proper bed-clothing, and, when necessary, hypnotics. These medicines should, however, be avoided if possible, as they are nearly always attended by some untoward effects.

In the comparison of narcotics and hypnotics they are ranged in the following scale: Morphine, chloral, amylene-hydrate, paraldehyde, and sulphonal. If they were arranged, however, in order of hypnotic power, and at the same time their innocuousness, they stand in the following order: Chloral, sulphonal, amylene-hydrate, paraldehyde, and morphine. Jastrowitz (Deut. med. Woch., Aug. 1 to 20, '89).

Curious instance of aphasia that appeared in an hemiplegic, following the administration of 15 grains of sulphonal. Sleep was produced which lasted the entire night, but upon the following morning the patient was completely aphasic, and this condition lasted for eight or ten hours, the patient meanwhile feeling very debilitated. Kisch (Berl. klin. Woch., No. 7, '89).

Sulphonal administered to forty-one insane females. Disagreeable effects frequently observed: frequent spitting, uneasiness, vomiting, staggering gait, and sometimes diarrhœa. If sulphonal was discontinued the patients, without exception, recovered completely. It should never be given in daily doses of 30 to 45 grains more than several months without discontinuing it from time to time. Schedtler (Therap. Monats., June, '95).

Forty-six to 62 grains of sulphonal are necessary to get the best hypnotic effect. Sleep is produced quite rapidly. The same persistence of the hypnotic effect after the suspension of the drug is observed. The nervous disturbances from sulphonal are divided into four groups: (1) those which compare to the well-known feelings in the morning, after a heavy drinking-bout of the night before; (2) that of drunkenness, with all its peculiar individual traits; (3) where ideation and memory are failing; (4) those of stupor, vertigo, difficulty in walking and speech, and even paresis of the limbs. Marandon de Montyel (La France Méd., Nov. 14, '89).

Sulphonal found useful in many cases among the insane, and comparatively inert among others. In 100 cases it was followed with 80 per cent. of successes, the average time in which sleep came on being three hours. The average dose administered was 12 grains. L. C. Toney

(St. Louis Med. and Surg. Jour., Jan., '91).

In comparing trional with sulphonal, preference given to the former as an hypnotic. Steiner (Deutsche med. Woch., No. 13, '95).

Unusual toxic effect of trional observed in a case of insomnia when renewed small doses were administered. J. W. Irwin (Amer. Therapist, Oct., '95).

The special and elective action of potassium bromide on the bulbar region, with elective action of opiates and chloral on cerebral lobes, may be advantageously combined. The following mixture recommended:—

R Potassium bromide, 2 drachms.
Chloral-hydrate, 1/2 drachm.
Syrup of morphine (French Codex, 1/6 grain to the ounce), 1 ounce.
Distilled water, 3 1/2 ounces.—M.

Luys (Lyon Méd., July 14, '95).

Chlorobrom—a mixture of equal parts of potassium bromide and chloralamid dissolved in water—has less action upon the heart and blood-vessels than chloral. Not particularly disagreeable to take and leaves no ill after-effects. Wade (Amer. Jour. of Insanity, Apr., '95).

The hydrochlorate of morphine is of great value in the treatment of mental and nervous disorders. Aug. Voisin (Bull. Gén. de Thér., Apr. 15, '91).

In the employment of hypnotic measures excellent results may be obtained with the wet pack. Though it produces sleep in patients with a very high degree of excitement, in some cases it became necessary to repeat the application frequently for a period extending over half a year, but no diminution in its effects were observed. Umpfenbach (Ther. Monats., June, '89).

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Lactophen given for insomnia in over 200 cases, with very good results. The dose given varied from 15 to 45 grains, the drug being administered in some sweet emulsion. Like most hypnotics, it loses its effect after continued use, but after a short intermission can be used again with good results. It is quite safe and more generally useful—in insane subjects—than opium, chloral, trional, or other hypnotics. Cristiani (Rif. Med., June, '98).

Opium is rarely necessary in insanity in children; when sedatives are required, a warm bath daily will be found useful, and when there is intense delirium one can add to this the application of cold to the head; in other cases a wet pack will be preferable. The administration of bromide of sodium in doses according to the age of the child will act as a calming agent, especially in cases of epileptic mania. In cases where there is much sleeplessness trional, in doses of from 3 to 8 grains, may be given for a few nights. A tonic treatment is to be pursued, and in those who masturbate the administration of quinine and camphor will be found convenient. Care must be taken to keep the bowels well open. Open-air exercise is to be employed in all cases, but gymnastics should be made use of as a recreation in cases of melancholia, and as a regulator of movements in choreic insanity. In some cases it will be necessary to stop all intellectual occupation; in others to encourage it, and also to make the child interested in the general affairs of life.

One of the most important parts, if not the most important, of the treatment is the separation of the child from his friends. Visits from friends should be permitted rarely at first, and regarded as a favor or reward for good behavior.

Children suffering from moral insanity should be put into institutions in which they should undergo industrial training, and be kept under control during the period of their lives.

The prevention of insanity in childhood is most important. Life in the open air, work in a garden or on a farm, recreation of all sorts, absence of forced prolonged intellectual labor, and the suppression of excessive emotion are the chief hygienic indications in those predisposed to insanity. Fletcher Beach (Journal of Mental Science, July, '98).

When food is refused on account of gastric derangement, lavage of the stomach and careful systematic feeding will

soon correct the disturbance. Refusal owing to hallucinations and delusions may sometimes be overcome by tactful solicitation, but in other cases forced alimentation must be resorted to. Often the tubular mouthed vessel called a "duck" will enable sufficient liquid food to be introduced. Where this is not successful the food must be given through a nasal or œsophageal tube. Many alienists prefer the former, but in the experience of the writer the œsophageal tube is as convenient as the other, and its larger calibre allows the requisite quantity of food to be introduced into the stomach more rapidly.

Care must be taken to vary the food given through the tube. The constant use of milk or milk and eggs often offends the stomach and failure of digestion results. Such vegetables as potatoes, rice, beans, peas, or lentils can be mashed and reduced with milk to a thick fluid mass, easily passed through the tube. Beef can also, after thorough boiling, be pounded in a mortar, or ground in a meat-grinder and likewise reduced to a thick paste. The various beef-juices (not extracts) and beef-powders, such as Mosqueras, or peptonoids, may also be given in the same way.

(See Anorexia Nervosa, volume i.)

Sitiophobia treated by first washing out the stomach through the stomach-tube, and then introducing food through the same tube. There is, in most cases of refusal of food, a catarrhal state of the stomach at the bottom of the hallucinations. Voisin (Bull. Gén. de Thér., Jan. 30, '91).

Literature of '96-'97-'98.

Complete refusal of food for twenty-four hours by a strong, well-nourished patient, and the missing of two meals by a feeble one considered sufficient indications for the stomach-tube. Harris-Liston (Brit. Med. Jour., Feb. 13, '97).

I have found the subcutaneous infusion of an albumin-salt solution extremely valuable in cases of sitiophobia, as well as in other conditions in which food could not be taken into or retained in the stomach. The fluid consists of a pint of sterilized normal salt solution (0.6 per cent. chloride of sodium, about 45 grains to the pint) in which the whites of two eggs have been whipped up and the whole strained through gauze. This is put into a nasal-douche bottle, to the tube of which is attached an aspirator-needle of small calibre. The skin over the back, loins, or buttocks is disinfected and after the fluid is allowed to flow through the tube and needle to get rid of the contained air, the point of the needle is inserted well under the skin. The bottle is then moderately elevated and the fluid allowed slowly to penetrate the connective tissue. It takes about fifteen minutes to infuse a pint of fluid under the skin. The prominent swelling which results usually disappears in the course of an hour or two. The proceeding is not very painful, and leaves no bad local after-effects.

Case of somatic insanity treated by means of subcutaneous injections of salt solution, two quarts a day being used until 15 quarts had been introduced. The improvement was marked and immediate. G. F. Keene (Boston Med. and Surg. Jour., Oct. 4, '94).

Literature of '96-'97-'98.

In some cases of acute mental disease, cases showing autoinfective symptoms, and in cases refusing food, excellent results have followed the employment by hypodermic transfusion of large quantities (one litre) of 0.75-per-cent. blood-warm sterilized solution of sodium chloride. The injections are made into the loose areolar tissue of the abdominal wall or gluteal region once daily. James T. Searcy (Alienist and Neurol., Apr., '97).

Among the means of treatment employed in acute cases of insanity, none surpasses, in effect, rest in bed. The patient with acute confusional insanity, mania, or melancholia, usually comes under the notice of the physician in a condition of great exhaustion. Bed-rest in these cases is imperative. I have found it better in these cases to treat the patient in an open ward, in the presence of other patients, and not in an isolating chamber. The suggestive influence of other persons in bed and apparently sick has a favorable effect, and the patient soon yields to the suggestions of physicians and nurses and regards himself as sick and in need of treatment.

The insane should be regarded simply as sick persons; they should be removed to hospitals, or detained there in the same manner as cases of infectious disease are taken in charge and isolated by the health authorities. Stephen Smith (Amer. Jour. of Insanity, Jan., '94).

Literature of '96-'97-'98.

In a great number of cases of fully developed mental disease of some standing, with fits of alarm, hallucinations, maniacal excitement, etc., the symptoms yield to rest of one or two weeks in bed, whereas in other circumstances a much longer time would certainly be required. L. Meyer (Jour. of Mental Sci., Apr., '96).

Twenty-eight male patients, including 8 general paralytics, 6 cases of dementia, 5 of melancholia, 4 of paranoia, and 1 each of catatonia, psychosis, hysterica, senile dementia, and cerebral syphilis treated with complete rest in bed. The weight of the patient usually fell at first, but increased again after some weeks. As regards the duration or cure of the disease, bed-treatment has no influence. Trapesnikow (Neurol. Centralb., p. 142, '98).

Series of female patients treated by rest in bed, including 3 cases of secondary dementia, 1 of chronic paranoia, 2 with chronic hallucinations, 2 with amentia, and 1 each with maniacal exaltation, melancholia, circular insanity, periodic insanity, and organic cerebral dementia. In some patients good results were obtained, but not in all. Weight was often lost, and sleep, appetite, and the action of the bowels were all prejudicially interfered with, and hypnotics had to be used just as frequently. Bed-treatment is only useful for individual cases. Ossipow (Neurol. Centralb., p. 142, '98).

Mechanical restraint and seclusion in a dark or barred room are not necessary in the treatment of insanity in any of its forms and should never be employed.

Literature of '96-'97-'98.

There is a class of cases in which the use of mechanical restraint is beneficial, but it should never be used except for the protection of the patient; and not for cases of violence or destructiveness. P. Maury Deas (Jour. of Mental Science, Jan., '96).

Emphatic condemnation of the custom of using dark cells for the purposes of punishment in prisons, the main cause of insanity among long-term prisoners. Twenty-three per cent. of the life-men in the prisons of the State of New York are inmates of the Matteawan State Hospital to-day. Most of them are hopelessly insane. H. E. Allison (Albany Med. Annals, Dec., '97).

Special Forms of Insanity.

Group I. Psychoses due to Imperfect Development of the Brain.

Idiocy and Imbecility. — These two conditions of defective mental function are merely different in degree. They are both dependent upon defective or arrested cerebral development. This defective development may be hereditary, congenital, or acquired; that is, it may occur in intra-uterine life, during the parturient process or after birth. In the United States idiots and imbeciles are generally grouped under the term "feeble-minded."

Idiots sometimes appear to be without any intellectual development whatever, having no power of thought, memory, or judgment. But these extreme degrees, if they occur at all, are rare. The sensory organs may be normal, and the vegetative functions well performed.

In imbecility the arrest or perverted development of the brain has not proceeded to the same degree, and there is more or less intellectual power. The memory and certain special faculties, as the musical, are sometimes highly developed in imbeciles.

Frequency.—The proportion of feeble-minded is about 1 in 500 of population. Males outnumber females 2 to 1.

Causation.—Idiocy and imbecility are hereditary in about one-half of all cases. The principal conditions in the ancestry supposed to influence the heredity are insanity, nervous diseases, intemperance, consanguinity, and tuberculosis. Contrary to general belief, intemperance in the parents is a factor in only about 10 per cent.

> The physical characteristics are transmitted by inheritance. Mental receptivity transmissible. Idiocy and imbecility may be a defect, having an origin in consanguineous marriages, prenatal conditions, accidents, arrested development, infantile meningitis, tuberculosis, lack of potency on the part of one of the parents from unexplained causes. Chapin (Phila. Polyclinic, Mar. 23, '95).

> In a careful examination into the family history of 1044 idiots, there were found 397 families, or 38 per cent., with a history of insanity or imbecility, and 225, or about 21 1/2 per cent., of various neuroses. While consanguinity is commonly accounted a fruitful cause of idiocy, comparative investigation shows, first, that children having both mental and physical defects are the offspring of healthy unrelated parents; second, that perfectly developed children with no personal peculiarities whatsoever may be the issue of consanguineous marriages. M. W. Barr (Jour. Nervous and Mental Dis., June, '95).

Literature of '96-'97-'98.

> In an area of four square miles in County Meath, Ireland, with a population of about 300 persons, one-half of the families have one or more insane, suicidal, idiotic, or goitrous members. Attributed to consanguinity and heredity, as the conditions under which the people live and their agricultural employment neither account for the endemic nor serve to limit it. Laffan (Brit. Med. Jour., Sept. 26, '96).

A considerable proportion of cases of feeble-mindedness is doubtless due to traumatisms during the process of birth. Prolonged labor, subjecting the brain to undue compression, direct traumatisms from the use of instruments or improper methods of delivery; convulsions in the mother, with consequent poisoning of the fœtal blood by carbon dioxide or by anæsthetics used to relieve the maternal convulsions; or premature birth may produce such a disturbance of nutrition in the brain as to arrest or retard its development. It is probable that the number of children in whom the arrest of development has begun at the time of birth is much greater than is generally supposed. Many of the cases of idiocy and imbecility among the offspring of parents entirely healthy, or of high intellectual ability, and which furnish such choice food for heartless gossip among the ignorant and uncharitable doubtless begin as the result of some such avoidable or unavoidable accident. The actual proportion is not ascertainable.

Acquired idiocy, beginning in infancy or childhood, is due to the toxic influence of infectious diseases, to injuries, rachitis, meningeal inflammation, fright, convulsions, and improper training.

Literature of '96-'97-'98.

Both idiocy and imbecility may be dependent upon early epilepsy, but the absence of spastic symptoms, contractures, strabismus, and other deformities, together with the absence of progressive deterioration associated with the occurrence of the convulsions, is characteristic of the acquired type rather than the hereditary. Theodore B. Hyslop (Med. Press and Circular, Feb. 26, '96).

Symptoms.—The physical stigmata of degeneration are well marked in idiocy. Of these the most notable is microcephaly, or abnormal smallness of the cranium. This may be due either to imperfect growth of the brain from intrinsic causes, or to premature closure and ossification of the cranial sutures. The last-named cause was formerly supposed to be much more potent than it is regarded at present.

In contrast to microcephaly, many cases of idiocy show a larger skull than normal. In these cases there is usually hydrocephalus, which may sometimes be extreme.

Irregularity or asymmetry of the skull and brain are also present at times.

Defective development of the remainder of the body is frequent.

Eleven cases of funnel-breast collected from the literature and five new cases reported. Funnel-breast is one sign of physical degeneration. In ten of the reported cases there were hereditary psychopathic conditions (idiocy, epilepsy, imbecility, and delusional insanity). In only one of the cases was there slight scoliosis. No evidence of rachitis. In the other cases the history was incomplete. J. Ramadier and P. Sérieux (Nouvelle Icon. de la Salpêtrière, Sept., Oct., '91).

Funnel-shaped thorax. (*Ramadier and Sérieux.*)

The comparative smallness and weakness of the heart peculiar to idiots is general, and not the result of atrophy or degeneration following disease. The diminished size of the heart is greater in proportion than the diminished size of the brain. Wulff (Jour. of Mental Science, Jan., '95).

Pareses and paralyses are among the physical symptoms often noted. Epilepsy and other forms of convulsions are

also frequent complications. There may be various tics, athetosis, and atrophy of paralyzed limbs. Strabismus is common.

Deafness is extremely uncommon among the feeble-minded; on the contrary, an acuity of hearing with a considerable development of the musical sense, is not infrequent.

Psychical Symptoms.—The defective intelligence is the most marked characteristic of the idiot. There may be shrewdness, or rather cunning, a retentive memory, acuteness of the special senses, and even the mathematical faculty may be highly developed in certain directions, but judgment and self-control are lacking. There is nearly always defect of articulation; indeed, articulate voice may be absent altogether, the only vocal sound the idiot can make being an inarticulate cry. The expression is generally placid and good-natured. He seems often to feel the necessity of guidance, and fawns upon those with whom he comes in contact. At other times, however, especially when his training has been neglected and he has acquired bad habits, his expression may become brutified. At best, the idiot is not an agreeable companion.

Self-control is often lacking. The slightest irritation causes an outbreak of rage during which he may commit violence. Sexual instincts are often active. Masturbation is frequent and its constant practice still further brutifies the defective subject. The uncontrolled sexual desire may also lead to offenses against morality in both sexes. Sexual perversion is not infrequent.

There is often a perversity of character, a collection of bad habits, which make the idiot or imbecile an extremely offensive companion. He will strike without provocation, spit at those who endeavor to correct him, and he seems to have an especial tendency to soil his clothing with excretal matters. It is very probable that these habits are the result of bad training, some of them being adopted as means of defense against those who use the idiot as a butt for their miscalled pleasantries,—unpleasantries would seem the better word.

The so-called "moral idiot" belongs to the same class with the other idiots. While his apparently total lack of regard for the moral law is the most prominent of his characteristics, a careful examination and consideration of his history will show that the essential feature of his malady is weak-mindedness.

Cretinoid idiocy differs entirely in pathology and etiology and is treated under another heading. (See Infantile Myxœdema, volume iii.)

Diagnosis.—In the absence of a history of the subject the only difficulty of diagnosis possible is with consecutive dementia. In advanced stages of this condition the resemblance to imbecility is sometimes great, but a short period of observation will usually show points of divergence. The malady of the chronic dement is progressive; the symptoms of the idiot remain unchanged.

The recognition of idiocy in early life is important, but the delay in the normal development of the intellectual powers generally postpones the recognition of feeble-mindedness in children until the third or fourth year.

Prognosis.—The prognosis of idiocy and imbecility, taking into account the pathogeny of the condition, is unfavorable. There is at present no means known to medical science or art by which a brain defective in structure or organization can be made perfect. But training by tactful teachers in properly equipped institutions, and in some cases of contracted skull, surgical intervention, to

permit the brain to expand, have wrought great improvement. In cretinoid cases the administration of thyroid extract has produced marked changes for the better. (See ANIMAL EXTRACTS, volume i.)

Treatment.—The treatment of feeble-mindedness should be primarily prophylactic. The irrational way in which many children are brought up leads naturally to imbecility. If anatomical defects are at the base of the feeble-mindedness, no method of treatment known offers any chance of improvement. In cases where premature synostosis of the skull is certainly present, there should be no hesitation to do Lannelongue's operation of craniectomy. While the results of the operation to the present time have not been generally encouraging, there is sufficient ground for the hope that some good will result from the operation in properly-selected cases.

The main reliance must be placed upon good pedagogic methods. The idiot must be taken in hand as early as practicable by a qualified teacher. Correct habits must be taught and their practice enforced by constant supervision. The idiot must be looked upon as an unfortunate, and not as a pervert with criminal instincts. Endeavors must be made to lead him to correct behavior. It will be found usually much easier to lead than to drive him.

> More benefit is to be anticipated from training than from operation in microcephalus, since the condition is generally dependent on faulty intra-uterine brain-development rather than premature synostosis. G. E. Shuttlesworth (Brit. Med. Jour., Sept. 28, '95).

The mistake must not be made of expecting too much from training an idiot. The best qualified teacher cannot make brains. He can only utilize those he finds ready to hand.

GROUP II. PSYCHOSES DUE TO VICIOUS OR ABNORMAL BRAIN-ORGANIZATION (ALWAYS HEREDITARY).

Paranoia.

Definition.—A chronic, inherited, incurable form of insanity, generally progressive, characterized principally by hallucinations and persistent delusions, and rarely terminating in dementia.

The literal meaning of the term paranoia is a dislocation or displacement of the mind; the German term is *Verrücktheit*. In most cases the intellectual powers are preserved and the affected person may reason with much correctness. His conclusions follow logically upon his premises, but as these are wrong the conclusions are likely to be false. The milder forms are generally known as cranks. It has become the fashion to call these persons degenerates, and to class them with geniuses, criminals, saints, musicians, artists, and anarchists. Obviously such an heterogeneous commingling of discordant elements fails to make clear to the ordinary mind what a crank or paranoiac really is.

Development.—The person burdened with an inherited neuropathic tendency usually shows psychical evidences of it in early life. There is in childhood excentricity, abnormal reserve, morbid pride, at times uncontrollable anger; the child is peculiar, is not like other children. At an early age there may be already evidences that the child regards itself as ill-treated by parents or others; its merits are minimized, its faults exaggerated. The other children in the family always get more than their share of praise. This morbid sensitiveness, usually baseless, is often accompanied by excessive precocity. Prizes are gained in school which are, however, generally regarded as entirely inadequate rewards for the tasks accomplished.

After puberty generally, sometimes

not until after middle life, the excentricities of behavior become more marked. The subject cannot live in peace and amity with anyone for a long time; he develops hallucinations and delusions. These are generally present at some stage of the disease, although its development may stop short of their production.

The hallucinations and delusions dominate the thought and conduct of the subject. As Krafft-Ebing says: "The paranoiac feels and acts as if his delusions were true."

From the twentieth to the fortieth years the excentricities, hallucinations, and delusions either gradually or by sudden accessions become more marked. The delusions become systematized, as it is termed. That is to say, the delusions assume a regular character, not varying except in increasing intensity and greater specialization. Thus, a subject, fancying himself persecuted by the world in general, will gradually pick out a person whom he regards as his especial persecutor, to whom, or to whose machinations he ascribes all his misfortunes, real or imagined.

[The genesis and gradual development of a delusion and hallucinations are beautifully and artistically worked out by Du Maurier in his novel, "Peter Ibbetson." Similarly, but less successful from the stand-point of scientific accuracy, is the genesis of delusions of persecution in "The Statement of Stella Maberly," a novel by F. Anstey. In both of these books the catastrophe, homicide by the leading characters, is the direct consequence of the domination of the will by hallucinations and delusions. Two characters stand out prominently in the history of the world as examples of paranoia: one, the Roman Emperor Caligula, and the other the Czar, Ivan the Fourth, surnamed the Terrible. In the graphic pages of Suetonius one can follow the at first gradual and then more rapid development of the delusions of grandeur and of persecution, together with the sexual excentricities and the hallucinations of hearing of the imperial Roman madman. The historical data upon which the paranoiac character of Ivan is based are full and well supported. It is, however, in a romance, "Prince Serébryam," by Count Alexis Tolstoi, translated into charming English by Jeremiah Curtin, that the hallucinations, the delusions of suspicion and persecution, of grandeur, of religious exaltation are traced with the hand of a master. It is strange that the best descriptions of this form of insanity come to us from the hands, not of physicians, but of writers of fiction. GEORGE H. ROHE.]

Symptoms. — HALLUCINATIONS. — Among hallucinations, those of hearing are most frequent and annoying. They may be simply disturbing noises, but are usually recognized as distinct voices often attributed to particular persons. Rarely the character of the hallucinations is pleasant and agreeable; much more frequently they are irritating. Thus, in the most frequent form of the auditory hallucinations the subject hears persons accuse him of dishonesty or other improper practices, persons call him opprobrious names, or he hears conversations which reflect upon him in various ways. Under the influence of these hallucinations the patient may make complaint to the suspected person, or invoke the aid of the law to right what the patient considers wrongs done him. When these measures fail, the patient may take the law into his own hands and endeavor to right the wrongs himself.

[Thus, a young man of fair education, and who was in all respects an excellent clerk, fancied he heard his employer reflect upon his honesty. He complained to the employer of the supposed injustice and was informed that he was entirely mistaken and that, on the contrary, his services were very satisfactory. This quieted him for a time, when the voices returned. He then resigned his position and spent his time at his home brooding over his troubles. In the meantime the

hallucinations continuing, he purchased a revolver and spoke to some members of his family of the persecutions to which he was subjected to by his former employer. Finally, one day he went to the latter's house, and calling him to the door, fired at him, fortunately without doing any injury. Being arrested, his references to his hallucinations and delusions resulted in his being committed as insane. For months his conduct in the institution was extremely precise; he was quiet and well behaved, and in conversation refused to acknowledge the presence of hallucinations and delusions. In his correspondence with members of his family, however, the persistence of both was manifest. In another case, boys followed the patient in the street, shouting opprobrious epithets. He also had hallucinations of smell and taste, with delusions of poisoning. In another case, a woman (spinster), hallucinations of hearing were combined with those of smell and sight. A sexual tendency was manifest in the hallucinations, although the behavior of the patient was unexceptionable. Male attendants in the hospital, and sometimes visitors, would shout obscene remarks at her during the night. These were usually attributed to the most circumspect persons. On one occasion a high ecclesiastical dignitary visited the hospital, and a few days later the patient complained that she had been compelled to endure his presence and embraces during the previous night. Similar complaints, with no more reason, were made against some of the attendants. She imagined a machine by which obscene pictures were thrown on the walls of her room during the night which she was compelled to look at. These frequently kept her awake, she averred, during the greater part of the night. At table some of the attendants delighted in throwing a stream of putrid sewage from a hose between her plate and her mouth, so that she was prevented from eating. The latter behavior, which she regarded as particularly atrocious, was generally attributed to the women nurses in her ward. In other respects she was an extremely well conducted patient, an exceptionally good and industrious seamstress, and painfully neat and clean about her person, clothing, and room. GEORGE H. ROHE.]

Hallucinations of vision are often of a pleasurable character. The visions, so graphically described by Du Maurier in the novel before mentioned are examples. On the other hand, the visions may be disturbing or terrifying and aid in the genesis of delusions of suspicion or persecution.

DELUSIONS.—Delusions are usually evolved out of hallucinations, although they may originate independently of these. In paranoia the characteristic delusions are those of persecution, combined with delusions of grandeur. There are also delusions of personality, where the subject fancies himself another person.—usually one belonging to a higher social caste. Among the delusions becoming rather frequent at the present time are those of electrical and hypnotic influence and of thought reading. The electrical delusions are sometimes very complicated. The patient is controlled by a dynamo, or some modification of the telephone, which is in the office of the chief of police of the city. Through this the patient is annoyed by the police, the detectives, or corrupt politicians, whose names are mentioned by the patient with great freedom. When the patient wants to bring his complaints before the proper authority, the persecutor brings the machine into play and confuses the patient's mind or words to the extent that he cannot make an intelligent verbal complaint. He usually gives his complaint very extensively and often connectedly in writing. The electrical or hypnotic apparatus is also used to deprive the patient of sexual power, or to compel him to masturbation, which he regards as an attack upon his self-respect. If one does not believe his words it is easy to

prove it absolutely by a galvanometer which if attached to his head will show the presence of an electric current. A similar machine,—the description given is usually very vague,—is used to detect the patient's thoughts, and so get him into trouble.

[One patient, a woman, who was very much disturbed by the use of such a machine by the writer, invented one to counteract the influence of the first. Of course, the machine was never actually constructed; it existed only in the patient's mind. GEORGE H. ROHE.]

Under the influence of delusions of persecution, the patients themselves become persecutors: the *persécuteurs persécutés* of French authors. To this class belonged Guiteau and Prendergast, the assassins of President Garfield and Mayor Carter Harrison, whose history is so recent that no detailed reference is here needed.

The delusions of grandeur may be present with or without hallucinations. They are usually combined with delusions of persecution, although these may be in temporary abeyance. Thus, the asylum princes, saints, great generals, or even deities, while protesting their high estate, lament the fact that through the villany of others they are deprived of their just rights. These persons are also dangerous, because they sometimes seek to obtain by force the honors of which the world has robbed them.

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In the early stages of paranoiac disease the delusions relate to some encroachments upon the life, health, honor, or property of the patient. Such patients are usually self-centered, and from childhood have been reserved, suspicious, and often hypochondriacal. They are generally badly developed, and have the more common stigmata of degeneracy: as a want of symmetry of both sides of the face, a lack of development of facial bones, giving rise to the protruding chin and "whopper" jaw so characteristic of the descendants of the Emperor Charles V, or asymmetrical palpebral fissures. They are generally unduly responsive to all external disturbing influences, and the development of morbid characteristics may follow comparatively slight disturbing causes. Paranoia develops as an unmistakable disease when hallucinations of the special senses give rise to actual delusions. The delusions are at first, and often for many years, those of persecution, and their character is determined by their habits of life, system of beliefs, and above all by their antecedent mental development or education. They believe the world to be generally unfriendly to them and seclude themselves from their fellows.

Sooner or later, however, they are forced by vividness of their hallucinations to defy their enemies, and then develop dangerous tendencies. Most of the crimes committed by the paranoiacs are done at this stage of their disease. The terminal state of paranoia is what has been happily termed by one writer the stage of transformation by which through a further elaboration of his delusions the patient finally believes he has solved the terrible secret which has hitherto clouded his whole life. He begins to believe that he is persecuted because he is a superior being, and delusions of grandeur, power, and importance replace those of persecution; so that, though he may suffer, still he rejoices more than he suffers.

Every case of developed paranoia should be under custody and control until such time as the stage of transformation occurs. Henry M. Hurd (Nashville Jour. of Med. and Surg., May, '96).

Diagnosis.—The history of a neuropathic ancestry, the slow development, the persistent character of hallucinations and delusions, with the comparatively slight degree and late appearance of dementia differentiate paranoia from other forms of insanity. At times moderate grades of imbecility may simulate para-

noia, but careful observation for a time will usually permit a definite diagnosis.

> Four cases of chronic paranoia, showing degeneration of posterior cords of spinal marrow. Alterations of spinal cord in relation with psychical troubles of paranoia. Bernhard Feist (Virchow's Archiv, B. 138, H. 3, '95).

Prognosis.—As stated in the definition, paranoia is incurable. Krafft-Ebing says that in over one thousand cases under personal observation not a single recovery resulted. Remissions, and prolonged intermissions for a year or more may occur. These may be true lucid intervals with disappearance of all symptoms, but should not be regarded as permanent recoveries.

The duration of life is not shortened by paranoia. Dementia is not likely to occur until late stages, and then usually only to a moderate degree. Slightly marked weak-mindedness is, however, not unusual.

Treatment.—The paranoiac is always potentially a dangerous character, and hence requires to be kept under observation when the diagnosis is established. The restriction of a person's liberty is not to be lightly advised, but the advice is rarely improper in this form of insanity. The paranoiac is usually much better in an institution for the insane than when at large. His hallucinations and delusions become less disturbing, and he is largely deprived of the power of mischief. There are no "harmless cranks." They may be too cowardly to commit overt acts, but the fact that most of these characters when admitted to hospitals are armed with loaded revolvers or other concealed weapons is an indication of the trend of their thoughts. In all cases of paranoia the patient should be placed under strict observation and control. There is no other safe treatment.

> The paranoiac is a menace to society and should be sequestrated. C. B. Burr (Medicine, Nov., '95).

Recurrent Insanity.

Definition.—Recurrent or periodic insanity appears as states of exaltation (mania), depression (melancholia), or an alternation of the two (circular insanity), with intervals of apparent lucidity. Periodic dipsomania is one form of recurrent insanity. The tendency to recur persists throughout life, and dementia is rare.

Recurrent Mania.— Symptoms.—The essential feature of recurrent mania is the occurrence of exaltation of feelings without confusion of ideas. The usual symptoms of mania (*q. v.*) probably dependent upon cerebral hyperæmia come on often without any prodromic symptoms of depression. After a month or longer in the exalted stage, the patient gradually, sometimes suddenly, returns to his normal mental condition, which, however, is not to be mistaken for recovery. The victim of periodic insanity exhibits even in the intervals evidences of some involvement of the intellectual functions. The inherited tendency to mental disturbance is always discoverable.

> [I recall a well marked case in a physician of about 55 years of age. He had been insane five or six times before. The first symptoms of an attack were neglect of his patients and an exceptional interest in the religious life of his neighbors. He talked religion and dialectics to anyone who would listen to him. As the malady advanced he began to regard himself as a fountain of medical knowledge, capable of filling any chair in any college to which he might be called. He had proposed himself for any vacancy that might occur in one of the medical colleges of Baltimore. The branch to be taught did not matter to him; he was equally competent in all. George H. Rohe.]

During the attack there is usually some loss of weight. The first attack

most frequently occurs at puberty. In women succeeding attacks often coincide with the menstrual period.

> Psychical integrity of women during their menses is a question most useful to consider in legal medicine. It appears expedient to find out if the crime committed by the prisoner coincided with her menstrual period. Under the term "period" is included not only the days during which the blood comes away, but those that precede and follow it.
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> An examination of the mental condition should be advised when the criminal act coincides with this period. This examination is indispensable when the history of the patient reveals a neuropathic taint or the existence of mental trouble during former menstrual periods, or when the act itself discloses peculiar changes.
>
> When it is evident that the menstrual process exercised a powerful influence on the mental life of subject, she should have the benefit of this fact, even if no menstrual insanity can be made out in what concerns the application of the law in the given case. Krafft-Ebing (Jahrbuch für Psych., vol. x; Annals of Gyn. and Pæd., June, '94).

Prognosis.— Permanent restoration of normal mental function does not occur. Individual attacks are, however, recovered from and the patient remains apparently well until the next outbreak. The intervals between attacks may be weeks, months, or years. In one case now under observation the intervals are about two weeks.

Dementia is rare.

Treatment.—Chloral and bromide of potassium may be given to depress the circulation and cerebral exaltation. Krafft-Ebing recommends large doses of morphine at the beginning of the attack. In my hands sulphonal has given the best results. Fifteen to 20 grains are given every four hours and the quantity rapidly reduced as the maniacal condition passes away. In most cases the drug can be reduced to 5 or even 3 grains at a dose in the course of three or four days. The effects of the remedy upon the kidneys should be carefully watched. Bed-rest, baths, and good feeding are essentials in the treatment equally as important as medicinal agents.

Recurrent Melancholia.—The symptoms are usually those of simple melancholia without delusions; the attacks come on rapidly, and after a duration of some weeks or months disappear as quickly. Here is profound depression, loss of appetite, headache, and insomnia.

Prognosis.—Favorable, so far as the individual attacks are concerned, but permanent recovery does not occur.

Treatment.—The favorable effects of opium as manifested in ordinary melancholia are not so pronounced in the recurrent variety. Krafft-Ebing recommends the following for its ameliorating effects:—

℞ Sodii bromidi, ʒiiss.
Antipyrini, gr. xlv.
Codeini hydrochlorat., gr. v.
Aquæ destill., ʒiv.
Syr. menthæ pip., ʒv.

M. Sig.: One teaspoonful, gradually increased to 7 teaspoonfuls as required, twice a day.

Circular Insanity (Alternating Insanity).

Definition.—A form of insanity in which states of mania and melancholia alternate with each other with or without lucid intervals' intervening.

Symptoms.—The disease may begin with mania or melancholia. The initial mental disturbance, of variable duration, is followed, either directly or after a lucid interval, by the opposite condition. The duration of the cycle may be weeks, months, or years. In some cases there

are marked delusions. The maniacal stage is usually one of simple exaltation.

Diagnosis.—This is only possible after prolonged observation or when a trustworthy history of previous attacks can be obtained. Cases with lucid intervals between the stages of depression and exaltation are rare.

Prognosis. — This is unfavorable. The duration of the disease is for life. Dementia does not occur except in advanced stages. The exhaustion of the maniacal stage may shorten life.

Treatment.—The treatment is unsatisfactory. Chloral fails to quiet the exaltation and restlessness in the maniacal stage unless given in such doses as to be dangerous. In like manner, opium is usually of little benefit during the stage of depression. When possible, rest in bed should be enforced, especially in the stage of excitement.

Dipsomania.—Definition.—A morbid irresistible desire for intoxicating liquors.

Ordinary indulgence in alcoholic liquors must not be considered as dipsomania; neither are the various forms of drug-habit to be grouped with it. These habits are formed by repeated indulgence, which in the early stages can be avoided by the exercise of a little restraint. In dipsomania, on the other hand, the impulse that drives the subject to drink is due to an inherited neuropathic tendency which is too strong to be resisted when the opportunity to indulgence offers.

> In a case known to me, a prominent public man of fine domestic attributes, intelligent, strong-willed, a man known to the public as a leader or "boss," the desire would arise suddenly. He would attend political gatherings and banquets, would work out with his *confrères* the problems of carrying a district, or influencing a legislative body, and all the time refuse to take a drink. On the way home, in a car or carriage, he would pass a drinking-saloon; if a low or disreputable one it appeared more attractive; he would stop, enter and take a drink, which generally resulted in a prolonged debauch ending with an attack of mania a potu. In all this there was no pleasure in the indulgence. He was fully conscious of the degradation to which he subjected himself and his family. He had been repeatedly warned, both by his physicians and by his political friends who were interested in his supremacy, that continued indulgence would be dangerous, not only to his temporal prospects, but to his life. To all remonstrances he turned a deaf ear, and finally died in one of his debauches. George H. Rohe.]

Prognosis.—The prognosis of these cases is unfavorable. While drunkards may reform and opium and cocaine *habitués* relinquish their stimulus, the dipsomaniac is never cured of his morbid appetite.

Treatment.—This can only be symptomatic. Seclusion, withdrawal of alcohol, and in the event of delirium tremens, hypnotics, bed-rest, and food comprise the resources at command.

Psychoneuroses.—It is probable that the brain-organization in hereditary hysteria, hystero-epilepsy, and epilepsy is also primarily defective. The ultimate mental weakness in these states is, however, a form of secondary dementia, probably due to the repeated physical shocks to which the brain is subjected in the nervous explosions characterizing hysteria and epilepsy.

Group III. Psychoses due to Simple Disturbance of Nutrition (Anæmia and Hyperæmia) of the Brain.

Melancholia.

Definition.—Melancholia is a form of mental disturbance characterized by pro-

found mental depression with suicidal tendencies. Its physical basis is supposed to be anæmia of the brain.

Symptoms.—The symptoms of melancholia are physical and mental.

First in importance are those referable to the digestive organs. There is nearly always profound anorexia, often resulting in obstinate refusal to take food. This may be due to gastric disturbance, but is more frequently the consequence of visceral hallucinations and delusions which will be referred to later. The tongue is usually coated and the breath offensive. Constipation is nearly always present.

Involuntary defecation is frequent, not because the patient has lost control over the sphincters, but on account of inattention to the sense of fullness in the rectum.

In women there is usually arrest of menstruation. The urine is generally somewhat diminished in quantity and rich in phosphates.

> Urine of melancholics is much more toxic than normal urine; that of maniacs is less toxic. Brugia (Jour. de Méd., Feb. 12, '93).
>
> The toxicity of the urine was found to be diminished in maniacal states and augmented in melancholia. The urine of maniacal patients, when injected into animals produces excitation and convulsions; that of melancholic patients, restlessness, dejection, and stupor. There is often in insanity, as in eclampsia, an inverse relation between the toxicity of the urine and that of the blood, the latter being hypotoxic when the urine is hypertoxic and *vice versâ*. Régis (Le Bull. Méd., Aug. 6, '93).

Sexual desire is usually diminished.

In nearly all, perhaps in all, cases of melancholia there is depression of nutrition. The red blood-corpuscles and the percentage of hæmoglobin are reduced.

> Results of examination of the blood in fifty-two patients. In mania the corpuscles and hæmoglobin were normal or in excess in nearly all cases. In melancholia the hæmoglobin was deficient in all examined, and the corpuscles below normal in 50 per cent. In paresis and dementia, corpuscles and hæmoglobin were deficient. In paranoia the corpuscles were much above the normal, while the hæmoglobin was only slightly below. J. A. Houston (Boston Med. and Surg. Jour., Jan. 18, '94).

There is usually considerable loss of weight. The skin is usually dry and harsh.

The force of the circulation is diminished. There is usually passive congestion of the blood-vessels.

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> The blood-pressure varies in different forms of insanity; it is raised in persons who are depressed and who are suffering from melancholia; it varies in cases of so-called agitated melancholia; it is normal upon the recovery of a patient whose blood-pressure has been raised during the period of depression; it is lowered in persons suffering from excitement or acute mania; it is normal after the excitement has passed off and the patient has recovered; it tends to fall as the day advances, causing melancholiacs to be brighter and excited patients to become more excited; the depression following upon an attack of acute mania is not necessarily an active depression, but rather more exhaustive in type, and the blood-pressure in these cases may remain low until it finally returns to normal upon recovery; the blood-pressure is probably raised in stupor; it is not always altered in delusional insanity except when there is also some emotional disturbance; in healthy, active, and excitable persons it is low as compared with healthy apathetic individuals; the blood-pressure is raised in general paralysis of the insane when there is depression, while in the excited types of this disease it is low, as it is also in the later stages of all types; the feeling of weight and pressure upon the top of the head is apparently vascular in origin, and is lessened or disappears when the blood-

pressure is lowered. Maurice Craig (Lancet, June 25, '98).

Mental Symptoms. — The mental symptoms of melancholia are depression, hallucinations and illusions, delusions, fear of death, and tendency to suicide. The last-named is potentially present in all cases, but is active in many.

In simple melancholia there is profound depression, with a fear of never recovering either physical or mental health. In these cases the memory and judgment are usually preserved, but the patient is so entirely under the control of the depressive emotion that he cannot think normally.

In melancholia with delusions, the latter are usually those of self-accusation, self-abasement, or of justifiable persecution. The melancholiac feels that he is justly punished by God for some transgression, real or imagined. Indeed, he fancies usually that his punishment is entirely inadequate to the transgression.

The melancholiac seeks death either because he thinks he merits it, or—and this is perhaps more frequently the case—to escape from mental distress, which becomes unbearable.

[A patient of mine, who had set fire to her clothing and thus attempted to destroy herself, gave as an excuse that "the devil was after her and she tried to escape him." George H. Rohe.]

One of the most persistent delusions of melancholia is that there is destruction of the abdominal viscera and that no food can pass; that, if taken it will not pass and that it will cause the patient's death if forced upon him. The complaints of being "rotten inside" are frequent among melancholiacs. The physical demonstration of eating a meal, of living through it and maintaining the strength, and of the regular continuance of defecation has no effect upon the delusion. It persists in spite of the constant contradictions which the patient himself furnishes. On the other hand, it must be borne in mind that the sensations of obstruction may be real, and that an actual stenosis of the bowel may be present. Such cases have been reported by Clouston and by me.

The delusion that the patient has committed "the unpardonable sin" or "the sin against the Holy Ghost" is an extremely obstinate one. Savage regards this delusion as an unfavorable one, as patients manifesting it—"the unpardonable sinners," as he calls them—rarely recover. The nature of the unpardonable sin varies with different persons. Most of them cannot or will not define it.

In some cases the fear of impending death colors all thoughts and actions of the patient. Food and medicine are refused, because the patient will presently die. Nothing can be done to prevent it. In other cases all friends have deserted the patient, and there is nothing left but to die.

Most melancholiacs are more or less passive and quiet; beyond making verbal complaints of their sufferings they sit and brood over their troubles, which are always real to them. In other cases, however, there is great restlessness. The patients are constantly in motion, crying and lamenting, sometimes under the stress of their delusions there are outbreaks of violence, although these are rare.

The suicidal tendency is present in a large proportion of melancholiacs. Life is usually taken by violent means. Hanging, shooting, jumping from a height, cutting the throat, and drowning, are the most frequent methods. Even such painful methods as burning, and swallowing broken glass are resorted to. The attempts are sometimes very persistent.

Sometimes melancholia is combined with a stuporose condition,—"melancholia with stupor." In these cases the patient sits or stands all day long, mute, apparently taking no note of anything going on around him. There is sometimes also resistance to everything done for the patient. Some authors class the affection described by Kahlbaum under the name *catatonia* with stuporose melancholia, but in my opinion, catatonia belongs to the group of which general paresis is the type.

CAUSATION.—Anything that depresses the general nutrition in one predisposed to insanity may cause melancholia. The essential physical substratum of the disease is probably cerebral anæmia, although at present the morbid anatomical condition of the brain in melancholia is not known.

Melancholia believed to be a symptom of trophic disturbances of the anterior brain and the opposite to mania. In the latter there is an exalted disposition and increase of the cortical functions of movement and megalomania. In the former there is a sad disposition, a decrease of movement, and micromania, the delirium of which is of self-reproach. The basis of this depressed disposition lies in the want of functional hyperæmia of the cortex, which latter state, if exaggerated, produces the exalted disposition of mania. Meynert (Wiener med. Presse, June 6, '89).

Although melancholia may not be caused by an impoverishment of the blood *per se*, such impoverishment almost invariably exists, and, in a large majority of cases, improvement of the mental symptoms is coincident with improvement in the general health and in the quality of the blood. Whitmore Steele (Amer. Jour. of Insanity, Apr., '93).

Three cases of well-marked melancholia apparently dependent upon local pelvic disease. These cases recovered, physically and mentally, after appropriate local treatment. One of the cases had been insane four years, and had been nine months in an insane hospital. W. Gill Wylie (Med. Rec., Aug. 4, '94).

Analysis of 730 consecutive cases of melancholia admitted to the Carlisle Asylum during twenty-seven years. Taking the three grand groups of mental diseases,—melancholia, mania, and dementia,—melancholia formed a fraction over 25 per cent.,—334 males and 396 females; 58 per cent. were discharged recovered, 8 per cent. relieved, 4 per cent. unimproved, and 20 per cent. died; 219 were cases of simple melancholia and 511 melancholia with delusions; 65 per cent. had suicidal tendencies, self-destruction being actually attempted in 33 per cent.; in 29 per cent. some physical disease coexisted with the mental disorder. The physical diseases most frequently present were phthisis (70 cases), heart disease (57 cases), and cancer (10 cases). Two-thirds of the cases were between 30 and 60 years of age. The largest proportion of recoveries occurred between 10 and 30 years. The proportion of relapses was 22 per cent. Hereditary predisposition was ascertained in 38 per cent.

Leaving out of consideration hereditary predisposition and previous attacks, the cause of melancholia was found, in a marked preponderance of cases, to be of a physical nature. In over 400 of the 730 cases there was ascertained to be some such cause at work in originating the mental depression. Intemperance in drink was assigned as a cause in 84 cases, pregnancy in 7, parturition and the puerperal state in 20, lactation in 23, privation and starvation in 28, and in a large number of other cases there was some kind of physical disorder preceding the melancholia. In about 250 cases the mental depression was assigned to some moral cause. W. F. Farquharson (Jour. of Mental Sci., Jan., Apr., '94).

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Case of melancholia in which the patient had for two years suffered from hallucinations of hearing. He became depressed, sleepless, and took to drink. The voices heard were those of friends far away, and they goaded him on to

destroy himself in order to avoid disgrace.

He had constant headache on the left side, and had attempted to cut his throat.

Trephined, making a large opening over the centre for hearing, and found a serous cyst, which was drained. The patient completely recovered. Street and Damer Harrison (Liverpool Medico-Chirurgical Jour., July, '97).

In about one-half of all cases there is a psychopathic ancestry.

Diagnosis.—In many forms of insanity psychical depression is a stage in the development of the disorder. Thus, mania mostly begins with depression; in general paresis, although the feelings are usually exalted, there may be a depressive stage lasting nearly throughout the disease. Many cases of paranoia have a melancholy tinge, and in the toxic psychoses depression is not an unusual symptom. True melancholia must, however, be differentiated from these episodic depressions.

In true melancholia every emotion, thought, and act is dominated by the sense of profound depression. Nothing can dissipate the cloud of sadness that envelopes the patient. He is lost; there is neither relief for him in this world nor salvation in the next.

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The diagnostic criteria of incipient or simple melancholia may be reduced to the following clinical symptoms:—

1. Mental depression presenting all degrees of depressed states of feeling.

2. Insomnia, which may be slight or profound, but usually very persistent.

3. Headache or psychalgia, which is commonly referred to the occipital region.

4. Loss of normal body-weight, presenting all degrees.

5. Changes in attitude and physiognomy.

6. Impaired appetite with marked constipation.

7. Morbid introspection with selfish inclinations.

8. Morbid fear of objects or places constituting the phobias.

When these symptoms present themselves in any individual and become persistent, whether the cause be known or not, they constitute the actual presence of that form of incipient insanity known as simple melancholia. John Punton (Alienist and Neurologist, Oct., '98).

In catatonia there is rhythmical forms of movement and of speech alternate with rigidity and mutism. The rigidity affects mostly the muscles of the neck and shoulders. Attention drawn to the fact that rigidity of this nature is not confined to cases of catatonia. It also exists in all cases of melancholia to a greater or less degree; but it is especially marked in severe cases of the disease, and especially in those cases in which there is an element of stupor. It is most marked in the muscles of the trunk and neck; it is less marked, but very strikingly present, in the muscles of the shoulders and hips, and it is again less marked in the elbows than at the shoulders, less marked at the wrists than at the elbows, and it is practically absent from the fingers. Similarly the rigidity is less marked at the knees than at the hips, very slight at the ankles, and again practically absent from the toes.

Personal reasons for believing this proximal rigidity to be a true physical sign of melancholia are:—

1. That it does not occur in other forms of insanity.

2. That it disappears from the patient as he gets well.

3. That voluntary rigidity is of the peripheral type.

This is best observed in a resistant child.

Since rigidity is frequently associated with paralysis, one naturally endeavored to ascertain whether there was any weakness of movement at those joints where the rigidity was most marked. This paralysis has been detected. There is very little weakness to be detected in the elbow- or wrist- movements, but, if such a patient be asked to hold his

hands straight above his head, he has difficulty in doing so; and it will be observed in extreme cases that the upper arm is not nearly held vertically, and that the elbow is not quite fully extended.

This symptom seems most marked in those patients who suffer a large amount of mental pain, especially if associated with an element of stupor.

The conclusion is that in cases of melancholia the cells of the tissues throughout the body have their function of excretion diminished, as well as the cells of the cortex cerebri. W. H. B. Stoddart (Journal of Mental Science, Apr., '98).

Prognosis.—This is generally favorable. Under appropriate treatment, from 75 to 80 per cent. of cases should recover.

While melancholia in its uncomplicated stage is the most common of all forms of insanity, it nevertheless is perhaps the most curable. John Punton (Alienist and Neurologist, Oct., '98).

Treatment.—One of the first questions usually asked the physician who is consulted in a case of mental disturbance is: can the patient be treated at home, or is removal to an institution necessary? In cases of melancholia home treatment is often practicable, if an attendant with tact and firmness is secured. Even under these favorable circumstances, however, treatment in an institution should be advised. Refusal of food and medicine must be met with positiveness, and in case of resistance forcible feeding must be practiced. It is rarely necessary to resort to the nasal or œsophageal tube, and, in those cases in which it must be employed, a few trials are usually sufficient and the patient will thereafter take his meals with a little coaxing. It is not sufficient to know that the patient eats; the physician must assure himself that the quantity of food is sufficient to maintain the standard of normal nutrition.

As refusal of food is sometimes due to gastric or intestinal disorders, the patient should always be carefully examined to determine whether the gastro-intestinal canal is in normal condition. Catarrhal conditions demand appropriate treatment, and want of digestive power may, at times, be relieved by tonics, stimulants, and digestives. For brief periods, concentrated or partially digested foods, such as beef-juice, clam-juice, peptones, etc., may be employed with benefit.

For cases in which there is insufficient nutrition, but which will take food, dry peptones dissolved in Malaga wine recommended, and especially the following composition: Raw, chopped meat, 3 ounces 2 drachms; powdered sugar, 1 ounce 2 drachms; Malaga wine, 1 ounce 2 drachms; tincture of cinnamon, 1½ drachms. To avoid the danger of taeniæ, mutton is used or the chopped meat may be brought for a minute to a high temperature. For feeding by a tube the following daily ration is recommended: Four eggs, 2 quarts of milk, 8 ounces of Bordeaux wine, 1 ounce of meat-powder, with an addition of 2½ drachms of common salt. Lailler (Annales Méd.-psychol., Jan., '89).

Nux vomica or strychnine, quinine, phosphorus, or codliver-oil will often be found of use.

The systematic use of stomach-washing also promises good results in these cases.

There is usually constipation in melancholia. This should be counteracted by the nightly administration of compound licorice powder, cascara sagrada, or one of the usual anticonstipation pills. A mercurial followed by a saline purgative is good initiatory treatment, and a weekly repetition of the mercurial will be found beneficial.

Perhaps the most important remedy in acute melancholia is rest in bed. The depressed state of nutrition is a strong indication for bed-rest. It will be found

that the patients quickly respond to the good effects of this treatment. Supervision of suicidal cases is also much easier if patients are kept in bed.

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Bed-treatment strongly advocated in acute psychoses, especially in melancholia. Sérieux (Rev. de Psychiatrie, No. 8, '97).

The best treatment for melancholia is to encourage the patient to sink his own personality, in trying to help and uplift those who are in need around him. W. Xavier Sudduth (Med. Times, Jan., '98).

The production of sleep is most important. Depressing hypnotics, such as chloral, bromide of potassium, etc., are not beneficial. If an hypnotic is necessary, morphine, sulphonal, or paraldehyde should be used.

Sulphonal is an hypnotic of most remarkable intrinsic value in cases of insanity in doses of 30 to 75 grains. The use of sulphonal is sometimes attended with vertigo and difficulty in keeping the equilibrium, the patient appearing, in this respect, as if intoxicated. It may possibly be contra-indicated in the congestive forms of insanity. Garnier (Der Praktische Aerzt, Jan., Mar., '89).

It is preferred to give sulphonal dry on the tongue, to be followed by a liquid. The phosphates in the urine are increased by small and diminished by large doses. The action on the heart is opposed to that of digitalis. John Cumming Mackensie (New England Med. Monthly, July, '91).

Trional preferred to tetronal or sulphonal because of its greater efficacy and the absence of all poisonous symptoms from its use. Having a bitter taste, it should be given in as large a quantity of some warm liquid as possible, in doses of from 15½ to 46 grains. Randa (Inter. klin. Rund., Mar. 5, '93).

As trional may cause unpleasant effects in patients affected with heart disease, especially where there is defective compensation, it should be prescribed in such cases with the greatest caution. Keppers (Thèse de Wurzbourg, '93).

Chlorobrom is most favorable in melancholia, especially of the milder type; and in acute mania its action is fully as reliable and lasting as any other hypnotic we possess. Wade (Amer. Jour. of Insan., Apr., '95).

Chlorobrom highly recommended in melancholia and brain-exhaustion from overwork, when insomnia is the most serious symptom to combat. Keay (Lancet, Mar. 18, '95).

In 15 cases of melancholia the galvanic current produced remarkably good results. Jules Morel (Bull. de la Soc. de Méd. Mentale de Belgique, Mar., '89).

A pint of ale or beer, or a glass of whisky and water is often a better hypnotic than the medicines mentioned.

The tendency to suicide in melancholia requires careful and constant watchfulness. The patients with suicidal tendencies often display great shrewdness in lulling the suspicions of those having them in charge. The most attentive and watchful nurses are liable to relax their care, and, before preventive measures can be adopted, the patient has secured a weapon and taken his life. The attendant upon a melancholiac must have an intelligent appreciation of the patient's condition and of the persistence of suicidal impulses.

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A patient with melancholia, especially the agitated and the stuporous forms, should never be left alone night or day. The danger of suicide is always present and is often a matter of sudden impulse, peculiarly liable to develop if the patient is alone. The diet should be nutritious and quite sufficient. A low diet, so-called, is rarely, if ever, indicated. Pritchard (N. Y. Polyclinic, Mar., '96).

The medicinal agent of most value is opium. Many alienists object to its use on account of the alleged danger of contracting the opium habit, but when the

drug is disguised and is systematically administered, this danger can be guarded against. It is best given in the form of deodorized tincture diluted with whisky and combined with a laxative, as cascara, to diminish the constipating effects of the remedy. The latter, however, are not very marked after the medicine has been taken a few days. The beginning dose is 5 minims of the deodorized tincture, gradually increased to 30 or even 40 minims twice a day. Stress is laid on the regular administration of the drug. When opium or morphine are given at regular times to reduce anxiety or produce sleep, it fails entirely in producing its beneficial curative effect in melancholia. When the desired effects (quiet, diminution of intensity of hallucinations and delusions, disappearance of mental depression) have been obtained, the dose is gradually reduced to the vanishing-point.

In some cases the opium produces so much gastric irritability that it must be suspended. These are, however, very few.

Results of personal observations upon the use of opium in the treatment of melancholia summarized as follows: 1. Rest in bed for a prolonged period. 2. Every morning the patient is given on waking a glass of Hunyadi water, preventing in this way the disturbing effects of constipation. 3. Tincture of nux vomica is given in small doses twice daily before the two principal meals of the day. 4. Laudanum is used in progressive doses, commencing with 5 drops and increasing 5 drops each day until distinct improvement in the patient's condition is observed. The writers have never had occasion to exceed 200 drops daily.

After there has been a marked improvement observed in the physical condition spray-baths of short duration are employed. Bell and Lemoine (Annales Médico-psychol., Jan., Mar., '89.)

Systematic observation extending over two years, and embracing the employment of over 18,000 single doses of opium in the treatment of various forms of mental disturbance. The treatment embraced over 40 cases of melancholia, 4 of typical mania, and 50 of various forms of paranoia. Of the 43 patients of melancholia, 2 died of intercurrent diseases, 2 were removed by relatives, and 31 recovered. Although this success certainly cannot be wholly due to opium, as good food, rest in bed, etc., had a great share in producing the favorable results, still the beneficial effects of the opium cannot be denied. In those cases which did not improve under the use of opium, 6 were afflicted with a marked delusional state, with excessive mental disturbance. The opium was wholly given by the mouth, and the constipation, which was observed in about 50 per cent. of the cases, was successfully relieved by the fluid extract of cascara sagrada, and the diarrhœa, which was observed at the height of the treatment and at the suspension of the opium, by tincture of koto, 10 to 20 drops. It would be perfectly justifiable to continue the use of the opium for at least a year, if it could be shown that the intellect was not being impaired by its employment. In mania the bromides and hyoscine can be used to better advantage. Theodore Ziehen (Therap. Monats., Feb., Mar., '89).

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In considering the usefulness of any particular line of treatment in melancholia, due weight must be given to the tendency of this disease to recovery in the great majority of cases.

Taking then the indication suggested by the age of the patient for or against the use of opium, patients of fifty years of age and over react most strikingly to its employment, and rapidly improve under its use. On the other hand, patients of about thirty years of age and under are made notably worse by it. Those between the ages of fifty and thirty react uncertainly to opium; and where such cases do improve the progress toward recovery is much slower than in older patients. It does not appear that

the form in which opium is given is of much importance.

The dose should always be rapidly pushed to the limits of tolerance; and also continued sufficiently long to give it a fair trial.

In looking for a substitute for opium in cases of melancholia in the first half of life, no drug has given such good results as sulphonal. Given in average doses of 30 grains each night it speedily acts not only by inducing sound and refreshing sleep, but also by what might be called its after-effects: it makes a patient rather heavy during the day following its administration. This is an advantage: there seems to be mental suffering, and suicidal tendencies and obstinate refusal of food are often relieved. This after-effect of sulphonal must be reached by increasing the dose with caution if necessary, and maintaining it for a few days in the full amount, then gradually reducing it, and only increasing again if there is any threatening of a relapse.

It has not been found necessary to give a larger quantity than 30 grains; they always begin with this dose, and never give it more frequently than every night. J. R. Gasquet and J. A. Cones (Journal of Mental Science, July, '97).

An important thing in all cases of melancholia, as in other forms of insanity, is a careful examination of all the bodily organs, and the treatment of such as are diseased.

Mania.

Definition.—An abnormal exaltation of mental activity, with incoherence, hallucinations, illusions, and delusions of variable character. There is reason to believe that mania is accompanied by an hyperæmia of the cerebral cortex.

These symptoms may all occur as a stage in some other form of mental disturbance. Thus, paranoia, general paresis, gross brain disease, and developmental psychoses may have maniacal attacks as part of the clinical history. In true, uncomplicated mania the exaltation is the characteristic manifestation.

Symptoms and Course.—An outbreak of mania is usually preceded by some days or weeks of depression or irritability of the patient. He loses appetite, the sleep becomes disturbed, and there is observed a disinclination to his usual occupation. Sometimes there is headache, or a sense of pressure in the head. These symptoms, after a time, become changed in character. The depression disappears, the patient feels exalted and becomes talkative. If asked about his health, he will tell you he is well—"never felt better in his life," etc. Schemes for his own advancement or that of others are regarded in an optimistic spirit. Visits are made to friends and acquaintances and private business affairs are discussed with more prolixity and less reserve than are usually agreeable to others concerned. The recollection of past events is sometimes very accurate and the minutest and least important details of some long past transaction are often recounted in the most wearying manner for the hearer. The patient in this stage does not care whether you reply to him or not. He only wants a good listener into whose ears he can pour his connected or disjointed verbosity. He also usually becomes a voluminous letter-writer. In some cases there is a tendency to make rhymes which are sometimes very ingenious. This must be differentiated from the verbigeration or chattering of delirium or of acute confusional insanity.

The persistence of hallucinations and delusions in melancholia and paranoia is usually absent in mania. In this form of mental disturbance there is usually rapid change of delusions and hallucinations, often without apparent cause. The false sense-perceptions and ideas vary as rapidly as they sometimes do in dreams.

If unopposed in his irrational notions, the patient is usually in a cheerful, even happy frame of mind. Contradiction or opposition soon lead to irritability, and at times the patient may become so angry as to be uncontrollable. Under these circumstances maniacs may commit acts of violence, the patient's anger being entirely beyond his control. On the other hand, if the delusions are encouraged they "increase by what they feed on" and grow more persistent and insistent.

In connection with the mental exaltation there is often great restlessness. The patient may continue doing his usual work, but he does everything in a hurry. There is a more lively play of the facial expression. The patient frequently poses for effect. This is perhaps equally frequent in the two sexes, although more marked in women. Sexual desire is also enhanced, and, in advanced stages women are likely to exceed males in obscenity of speech and action. Masturbation is sometimes observed in mania, but much less frequently than in epileptic insanity. The open practice of the vice is comparatively rare.

In the more severe forms of mania all these manifestations are intensified. The rapid movements, the shouting and laughing, incoherence, obscenity, and profanity are greatly heightened in degree.

Articles of clothing, bedding, furniture, in short, anything that offers opportunity for tearing or breaking are liable to suffer destruction at the hands of the maniacal patient. He loses control over his sphincters, and wets and soils his bed and clothing, or defecates on the floor and then dabs his body or the walls of his room with his excreta. There seems to be anæsthesia in some cases; at all events slight injuries, that in the normal condition would give rise to complaints of pain, are either not felt or are thought unworthy of notice.

Fever is present in a considerable proportion of cases of acute mania. It should always lead to a careful physical examination to determine the presence of any local inflammatory condition. In two recent cases under notice the fever was due to considerable collections of pus. In one of these no pain was complained of; and yet on examination a large perirectal abscess was discovered which discharged about ten ounces of pus when opened. Mere functional derangement of the mind is not likely to cause appreciable elevation of temperature. There can nearly always be found some direct cause for the fever, either inflammatory or septic. The inflammation may be in the brain or its membranes, in the abdominal viscera, the pelvis, the external ear, the integumentary tisues, or the peripheral nervous system (neuritis). The septic infection may start from a wound, an abscess, or a diphtheritic patch, or it may be in the blood itself, as in various specific febrile conditions. Even when no physical cause can be discovered, fever is always a grave symptom, since, if it rises too high, exhaustion supervenes more rapidly.

The pulse in mania is usually full and regular. But when there is beginning exhaustion, as in those cases where the patient is constantly moving about, with insufficient food and sleep, the pulse is small and rapid. In these cases death from exhaustion is not infrequent.

An attack of mania may terminate in one of four different ways: (1) recovery; (2) death from exhaustion; (3) chronic mania; (4) consecutive dementia.

Diagnosis.—The diagnosis of the clinical form of mental disturbance termed

mania is sometimes rather difficult. As before stated, many forms of insanity have a maniacal stadium which may be, and often is, mistaken for a special disease. Hence prolonged observation, extended over days and sometimes weeks, is, at times, necessary to form a positive judgment. The greatest difficulty occurs in those cases due to septic or toxic causes which by many are not differentiated from true mania. In these cases the exaltation is often only apparent, the essential and characteristic manifestations being mental confusion or delirium.

The terms "acute confusional insanity," "acute delirious mania," etc., show that observers generally recognize a difference between these cases and those of simple mania. In the latter the essential manifestations are the exaltation, flight of ideas, and rapidly changing hallucinations and delusions.

Three conditions present separate hysterical mania from simple acute mania, or mania with delusions. They are: retention of memory, absence of mental perversion, and purposive conduct. Tomlinson (Jour. of Nerv. and Mental Dis., Apr., '91).

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Acute delirium and acute mania are frequently mistaken for each other, and their diagnosis from each other is somewhat difficult to make. The temperature is elevated in acute delirium, and lowered in mania. The exhaustion is very rapid in acute delirium, while the maniac will continue to rave for months with little perceptible loss of strength. Mania is a conscious delirium, the patient being aware of what he is doing and taking every advantage of others; acute delirium is an unconscious delirium, the patient never trying to take any advantage, and, although he recognizes people, five minutes later he does not remember to have spoken to them. In mania the appetite is often enormous; in acute delirium it is always absent. Mania is preceded by marked prodromata; the prodromata of acute delirium are never very marked and are often absent. In mania the face is often flushed and the sclerotic injected; in acute delirium the face is pallid and there is no injection of the sclerotic. Acute delirium will terminate in death or recovery in two or three weeks; mania will require months. Coston (Nashville Jour. Med. and Surg., Aug., '96).

Causation.—Aside from the influence of heredity, which can be traced in one-half or more of the cases, prolonged excitement of the cerebral centres, overwork, and mental strain of various kinds may be regarded as etiological factors.

All manias of an acute type which are not intoxication-neuroses, and are not due to the presence of organisms in the blood, are divisible into mania proper and confusional insanity. H. C. Wood (Amer. Jour. Med. Sci., Apr., '95).

The infectious origin of acute delirium shown in eight cases, in seven cases of which recovery or considerable improvement took place, eighth ending fatally. In the latter only did the blood reveal presence of bacilli. Bianchi and Piccino (Jour. of Nerv. and Mental Dis., Aug., '95).

Certain forms of acute mania and melancholia are due to nutritive derangements. Lavage of the stomach and intestinal disinfection have given good results in these cases. E. Toulouse (Jour. de Méd., June 5, '92).

Literature of '96-'97-'98.

Intestinal putrescence determines the presence in the urine of an appreciable quantity of indican, and when indican is present there is also a more or less marked alteration in the ratio of preformed sulphates. These indications are generally found in acute insanities, especially those characterized by rapidly developing symptoms. Changing illusions, hallucinations of unsystematized delusions, in association with insomnia, pallor, constipation, and rapid exhaustion, are, generally due to autotoxis of alimentary origin, and this condition is

also responsible for various post-febrile, traumatic, alcoholic, and drug insanities. A. McL. Hamilton (Med. Press and Circular, May 27, '96).

Masturbation can be, and often is, the sole exciting cause of insanity. Ralph A. Goodner (Med. News, Feb. 27, '97).

Twenty of the 47 juvenile cases personally observed were boys and 14 girls; the sex of the others was not stated. Of the 13 cases, 8 were boys and 5 girls. Up to 7 years of age convulsions and arrest of intelligence are most commonly observed, although delirium is often seen as the result of febrile affections. From 7 to 14 years of age true mania and melancholia are most frequent, while hysteria shows itself very often as soon as the menses appear.

Among the psychical diseases met with dementia is frequently observed. Acute dementia, which is the most common form, frequently occurs betwen the ages of 10 and 16, and differs from senile dementia "in that it seems to depend on the imperfect nutrition of the nervous system, and is generally curable by generous diet and other means that supply materials for construction."

Juvenile dementia, as a result of inherited syphilis, is occasionally met with. Mental deficiency is noticed at the age of the second dentition, and from this time gradual degeneration ensues, with sometimes paralytic and epileptic seizures, and death occurs in three or four years.

Monomania, or delusional insanity, is commonly met with. Erotomania has been observed in early life. The expression of the face and the gestures have an amorous languor, but, as a rule, the children so affected are chaste. Far more important is nymphomania and satyriasis, due no doubt to the influence of heredity and exaltation of the general sensibility.

Melancholia in early life may be sudden or insidious in its attack, a primary disorder, or the sequel of some other form of insanity. There are two forms: the first, a pure abstract indefinable depression; the second, a despondent condition, having relation to religious matters or a future state.

In mania delusions are more frequent than hallucinations. Of the 13 cases which have been under personal care, no less than 9 suffered from mania, and in 5 of these it came on after attacks of epilepsy. Moral insanity is of frequent occurrence in childhood, and hysteria has been frequently noticed. Fletcher Beach (Jour. of Mental Science, July, '98).

Prognosis.—Recovery occurs in about 70 per cent. of cases. When recovery follows it is usually only after several months, from six months to a year being the usual duration of an attack. The recovery is rarely sudden, or gradually progressive. More often the patient improves for a time, to drop back in a day or two into a condition of excitement, followed again by improvement, and thus recovery is reached by a series of stages of improvement overlapping a series of relapses. In other cases the passing off of the stage of excitement is followed by one of depression, out of which the patient gradually awakes to his normal mental activity.

Death from exhaustion usually occurs early. Ordinarily about 8 to 10 per cent. of cases of mania die from exhaustion. Under early and proper treatment, this proportion should be much diminished. Of the remainder the larger proportion results in progressive brain degeneration, presenting the characters of consecutive dementia.

Vacuolation of the protoplasm of the nerve-cell and nucleus and pigmentary degeneration observed as phenomena present in cases of acute delirium. T. P. Prout (Med. News, Aug. 18, '94).

Conclusions regarding prognosis of acute mania: (1) about 70 per cent. of all cases of acute mania are cured after running a course averaging several months; (2) early treatment in insanity hospitals has a favorable effect upon the course of the disease; (3) a family history of insanity does not necessarily make the prognosis unfavorable; (4)

cases of mania occurring as sequelæ to disease—alcoholism or pregnancy—have a favorable prognosis, both as regards duration and ultimate cure; (5) cases due to slight injury of the head usually recover: (6) the return of the menstrual flow accompanying an improvement in the mental condition is an indication of a speedy return to health; (7) the younger the patient, the greater is the hope of recovery; (8) recurrent mania presents a bad prognosis for complete and lasting cure; (9) where the disease is of long standing the probability of recovery is poor; (10) the sudden onset of great maniacal excitement is an unfavorable symptom except in those cases following pregnancy or traumatism of the head: (11) sudden stoppage of the maniacal excitement must raise the fear of recurrent mania or of early relapse; (12) great increase in weight before the beginning of the quiet stage must be similarly interpreted: (13) the more severe the attack, the poorer is the prospect of complete recovery; (14) paralysis and convulsions must be looked upon as grave complications. Willerding (Review of Insanity and Nervous Dis., Sept., '91).

Treatment.—The treatment of mania often requires great tact, perseverance, coolness, and command of therapeutic resources. In the first place, in case of any gravity, home treatment is generally impracticable. The noise, the motor unrest, the constant expert attention required, and the violence toward others make it incumbent in most cases to remove the patient to an institution for the insane. It is customary in most hospitals for the insane to isolate the maniacal patient. In the writer's experience this sequestration is not to the patient's advantage. Keeping the patient in an open ward, preferably in bed, in the presence of other patients, constantly suggesting to him by precept and example that he is sick and requires treatment will usually soon quiet the most excitable maniac. It may be necessary to keep one or more attendants by the bedside all the time, to prevent him from getting up and running about and so exhausting himself. A bath, clean linen, and quiet, tactful nursing will do wonders in calming the excitement and dissipating the delusions of the maniac.

Literature of '96-'97-'98.

In institutions that receive a large number of excited patients the association of the same in large observation-halls is accompanied with serious disadvantages. These disadvantages can be relieved: (*a*) by a separate observation-room for the extremely disturbed cases, and, eventually, a third for quiet and orderly patients, separate from the receiving-ward properly so-called; (*b*) by a subdivision of the observation-ward, and, finally, by removing the most affected patients into single rooms of a home-like appearance. By suitable architectural arrangements permitting this separation into single rooms, together with thorough watching and care, and the use of the treatment in bed; isolation in this form is to be considered as a valuable therapeutic method. Isolation for other than therapeutic reasons can in this way be reduced to a minimum, but cannot as yet be altogether dispensed with. For certain cases rooms of a stronger construction should be provided. Heilbronner (Amer. Jour. Insan., Apr., '97).

In the treatment of mania no restraint and rest in bed recommended, except when the strong-room is absolutely necessary. Baths, bromide and chloral, may be given, but for severe excitement or great sleeplessness an injection of hyoscine is necessary. Good nourishment should be given, but no beer, wine, or spirits. Baths at a temperature of about 23° C. given for two to five hours as a means of quieting the patient, with cold compresses to the neck. When the excitement is very great, instead of the baths a damp sheet should be used. In the evening 45 to 75 grains of bromide of potassium are given, and two to three hours later 30 to 45 grains of chloral. After ten days, if the patient is quieter,

the bromide is lessened and the chloral is only given occasionally, and sulphonal or trional are substituted. Where bromide and chloral are useless, laudanum in increasing doses is given. Magnan (Rev. de Psych., July, '97).

The general indications in the treatment of delirium are, first, to secure sleep; second, to overcome motor unrest; third, to prop up and maintain the patient's vitality by contributing to his nutrition; and, fourth, to discover and remove the cause upon which the delirium is dependent. Collins (Med. News, Feb. 26, '98).

Careful attention must be paid to the bodily functions. A useful preliminary is a large rectal lavement, to remove fæcal accumulations and prevent soiling of the bed. Feeding with nutritious food is of the first importance. Maniacs usually eat ravenously anything offered them. Care should be taken to prevent overloading the stomach with indigestible food. In cases where the pulse is weak and rapid, the addition of a moderate quantity of alcohol is often useful. Milk and eggs, with beef-juice, or partly predigested beef-powder, and some of the starchy invalid foods are perhaps the best form in which to introduce nourishment.

In cases of very active mania, a warm bath, with effusion of cold water, sometimes has such a calmative effect that patients who before refused food then took it freely. Binswanger (Centralb. f. Nervenh., Mar., '91).

Sleep must be secured. If it does not follow the measures here recommended within a reasonable time, some hypnotic must be given. Among the hypnotics least likely to disturb digestion or depress the appetite are bromide of potassium, chloral, hyoscine, sulphonal, and trional. Clouston highly recommends chloral, 30 grains, with 10 minims of the tincture of cannabis Indica. A combination of bromide of sodium and chloral, of each, 15 grains, with 15 minims of tincture of hyoscyamus is also an excellent calmative. In cases of great weakness and rapidity of the heart's action, digitalis, strophanthus, or strychnine may be added to the bromide-and-chloral mixture. Paraldehyde is a valuable hypnotic in cases with depression. It is given in doses of $^1/_2$ drachm to 1 drachm in $^1/_2$ ounce of whisky, diluted with a little water. It usually produces sleep within an hour. A bottle of ale or beer is often an excellent hypnotic.

Opium, which is so useful in melancholia is generally contra-indicated in mania. The brain-hyperæmia is simply increased by the drug, and the symptoms heightened. In the late stages, however, where there is brain-exhaustion and the descent into dementia seems imminent, opium sometimes pulls the patient together and enables him to recover.

Opium or morphine recommended in the acute stages of mania. The heart should be sustained by digitalis. In cases of hyperæmia nothing is better than ergotine. In obtaining sleep and inducing bodily quiet, warm and prolonged baths, also hyoscine. Krafft-Ebing (Inter. klin. Rundschau, May 25, June 1, 8, 25, 29, '90).

"Chlorobrom," a mixture of bromide of potassium and chloralamid, is also a satisfactory hypnotic in mania. It does not produce depression or derange digestion.

In mania, chloralose, in doses of from $1\,^3/_4$ to $15\,^1/_2$ grains; preferably given in solution in boiling water. Sedative effect in from fifteen to twenty minutes after taking the drug. Haskovec (Revue Neurol., Oct., '94).

Neutral duboisine sulphate an excellent sedative in all psychical and motor agitation. Sleep produced similar to physiological slumber. Dose varies from $^1/_{130}$ to $^1/_{40}$ grain. Loicano and Masuro (Med. Standard, May, '95).

Literature of '96-'97-'98.

In hypodermic doses of $^1/_{150}$ to $^1/_{75}$ grain scopolamine proved a good hypnotic in paroxysmal excitement, but not in habitual insomnia. It is especially useful in acute mania. Tomasini (Brit. Med. Jour.; Epitome. Dec. 4, '97).

Duboisine sulphate, by the mouth, and also hypodermically in doses of $^1/_{100}$ to $^1/_{50}$ grain, used in all cases of excitement: in acute mania its use was not followed by any beneficial results; single doses produced quiet for a time, but this was followed by more excitement. In delusional mania it was only used for outbursts of excitement, and was entirely satisfactory. In general paralysis the drug was used both occasionally and continuously, with satisfactory results. In melancholia bad results were seen; in no case was there any relief, and in some cases the excitement was increased, and there was a tendency to syncope, with hallucinations of sight and hearing. Used occasionally in dementia it gave satisfactory results, with rest at night. The danger of the drug is from cardiac failure, if given continuously. It should be used only in physically-healthy persons. On the whole, the drug is preferable to hyoscine or hyoscyamine, as the quiescent state induced is of longer duration, and there is less prostration. Skeen (Journal of Mental Science, July, '97).

Hydrobromide of hyoscine preferred to the hydrochloride. It is given in doses of $^1/_8$ to $^1/_{70}$ grain. In cases of mental excitement with delirium and destructive tendencies, especially in periodic mania, it is of great value, also in the delirium of alcoholics. In melancholia agitata as well as in other cases of sleeplessness, hyoscine often produces quietude when all other means fail. On the other hand, it is not adapted for all cases of an hysterical nature, and especially in affections which require a constant use of sedatives. Marked valvular trouble and fatty heart contra-indicate it. Doerner (Therap. Monats., June, '98).

After the acute stage has passed the physical strength returns, and the brain begins to return to its normal activity, great care is necessary to prevent relapses. All sources of irritation should be kept from the patient, visits of friends should not be allowed too soon or too frequently, and he should be kept under close observation until the normal mental stability is re-established.

Group IV. Psychoses due to Microscopic Structural Alterations in the Brain (Primarily Probably Nutritional or Toxic).

General Paresis.

Definition. — General paresis is a chronic, progressive, diffuse, structural alteration of the cerebral tissue, with involvement of the cortical and meningeal blood- and lymph- vessels, attended by characteristic psychical and motor disturbances. The disease is incurable and leads to death usually within three years.

Symptoms and Course.—No single symptom can be regarded as diagnostic of general paresis, even in the advanced stages. The diagnosis must be made from a study of certain concomitant symptoms, partly psychical and partly physical. Of the latter, the motor disturbances are, as the various names given to the disease indicate, the most characteristic.

Among the early psychical symptoms are irritability and especially an instability of the moral and mental character. The subject is easily disturbed, emotional, of variable moods. His memory, especially for recent occurrences, becomes defective. He forgets dates, appointments, mislays valuable documents or other articles. The moral sense is often perverted. He loses that delicate sense of propriety by which his previous life has been guided. He becomes unconventional, consorts with drunkards and lewd females, makes indecent proposals to respectable women of his ac-

quaintance, indulges in a latitude of speech and action not tolerated by the conventions of the social stratum to which he belongs; all this without recognizing any impropriety in it. He may make a public merit of his sociological study of the nude in brothels, and of his compounding with liars and perjurers. He may violate public decency by exposure of his genitals in the street, or show a coarse disregard for his own household by defecating in bed or urinating on the carpet in his room.

There is progressive inability to concentrate the attention. With the failure in memory, incidents, real or imaginary, are embellished with fanciful details, the truth of which is asserted and maintained with vigor, and all doubts are actively and often angrily combated.

The prevailing character of the psychical manifestations is one of exaltation. Cases occur not infrequently, however, in which the key-note throughout the whole course of the disease is depression. In some instances the diagnosis of melancholia would be justified if the psychical symptoms alone are taken into consideration. Delusions of persecution may also be present, but are generally attended by expansive delusions.

Delusions of grandeur are present in most cases of general paresis, although they cannot be regarded as essential or pathognomonic. Many cases of general paresis run their entire course without manifesting exaltation or expansive delusions at any time.

The delusions of grandeur are not only unreasonable, but the patient's reasons for his extravagant beliefs are either inadequate or he does not give any reasons. While his imagination seems to be vivid, as shown in his delusions, it is, in fact, decreased. His delusions are so unrestricted that the most modest healthy imagination at once recognizes their absurdity.

> [There are no limits to the wealth, the power, or the accomplishments of the general paretic during the height of his delusions. One patient was going to build a railroad from Rome to Chicago for the sole purpose of bringing the Pope to see the World's Fair; another had such acute vision that he could see a thousand miles without any difficulty; another owned the entire United States, France, and Spain, with outlying provinces in China, India, and South America. He could have England, also, but didn't want it so long as the queen lived. GEORGE H. ROHE.]

These delusions are rarely fixed; that is to say, they do not possess the permanent character of the delusions of paranoia. While there is a general sameness of the main feature,—the expansiveness of the delusion,—the individual delusions constantly vary.

As the disease progresses, dementia becomes more and more marked. The destruction of the intellectual faculties is so complete that toward the last even the delusions disappear. This progressive dementia goes hand in hand with the physical deterioration of the powers, so that when at last death comes to end the scene, the vital machine may be said to go to pieces like the "deacon's one-hoss shay."

One of the earliest physical symptoms is persistent insomnia, not yielding to hygienic or medicinal agencies. It is often accompanied by intense and frequently-recurring hemicrania. The sleeplessness and pain are believed by many to indicate intracranial pressure; but this is not absolutely certain. Ophthalmoscopic examination fails to show intracranial pressure. In other cases there is an uncontrollable desire to sleep. The patient falls asleep in the midst of his occupation or in company.

Early symptoms also are losses of consciousness varying in degree from momentary dizziness to apparently true apoplectic attacks. They are present in nearly every case and are important diagnostic signs. While they are frequent and severe in the advanced stages, they are often the first indication of serious cerebral disease. After severe attacks there may be hemiplegia, which, however, usually disappears in a few hours or days. These attacks are evidently not due to rupture or thrombus of the cerebral vessels, but probably to circumscribed œdema of the brain, which rapidly passes away.

[I have seen cases of general paresis in advanced stages with apoplectic attacks, sometimes with convulsions, followed by profound coma, contracted pupils, and Cheyne-Stokes respiration, and after predicting a fatal termination of the case within two hours has had the patients still in hospital three months later. GEORGE H. ROHE.]

Convulsions epileptiform in character, may also be present as early symptoms, but are usually met with in the later stages.

Sometimes the apoplectic attacks are due to internal hæmorrhagic pachymeningitis, and in these cases death often follows soon after the stroke.

Literature of '96-'97-'98.

Ordinary cerebral hæmorrhage constitutes the gross lesion in the majority of cases of paralytic insanity. It is also very common in senile insanity.

Multiple minute recent blood-extravasations are to be observed with considerable frequency in microscopical sections of the brain from the insane. Most of such hæmorrhages are capillary ruptures of very small size. When they take place from larger vessels, the blood is often merely poured into the adventitial lymph-space. W. F. Robertson (Edinburgh Med. Jour., Mar., '96).

Frequent among the early symptoms are those connected with the innervation of the iris. The pupil is usually irregular, mostly dilated, more rarely contracted, in the fewest cases normal in diameter. The pupils of the two sides often vary in size and reaction. The reaction to light and sensation may be retarded or entirely abolished. The Argyll-Robertson pupil, so characteristic of tabes, is also a frequent symptom of general paresis. It probably depends upon similar degenerative processes as in the former disease. It is said that the ocular symptoms,—inequality of pupils, myosis, and Argyll-Robertson pupil have been noted several years before the outbreak of the mental disturbances.

Two per cent. of all insane persons have lost the color-sense. The sense for violet is lost in about 10 per cent. of the cases, being almost exclusively limited to various forms of dementia (general paresis, senile dementia, organic dementia). This loss of color-sense is generally accompanied by a diminution of acuteness of vision and the sense of light. L. Cronstel (Thèse de Paris, '93).

Literature of '96-'97-'98.

Inequality of the pupils is at times met with in healthy individuals, and it occurs in general diseases of the most diverse nature. In 3010 cases of dementia paralytica the pupillary reaction to light was lost or diminished in 68 per cent. The Argyll-Robertson pupil of great diagnostic importance in general paralysis, and is one of the very early manifestations of the disease. It is usually bilateral; a continuous unilateral loss of the light reflex is very rare. The first change is generally a diminution of the reaction to light, then a total loss, followed by paresis and paralysis of reaction to accommodation. Siemerling (Berl. klin. Woch., No. 44, '96).

Other motor symptoms are changes in the deep reflexes. The patellar reflex is most often increased, but may be normal,

diminished, or absent. It has no diagnostic significance except in connection with other physical or mental symptoms.

The facial muscles often show signs of involvement. A fibrillary tremor or twitching of the muscles about the mouth, sometimes a spastic condition of single muscles or groups of muscles about the face, loss of expression from paresis of certain muscle-groups may be present. On protruding the tongue the organ is tremulous or protruded in a spastic or jerky manner. Tremor of the hands is also present as a symptom of the advanced stage. The writing becomes irregular and "shaky."

The speech is jerky, slow, or "scanning." In advanced cases it becomes slurring. Syllables are dropped or repeated. Certain words are pronounced with difficulty, the test phrase "truly rural" usually running into "toory looral." Later the speech becomes indistinct and finally degenerates into an inarticulate sound, in which no words can be distinguished. The early speech-defects are probably due to fibrillary tremor or twitchings of the tongue and lips. The later ones are paretic in origin.

Literature of '96-'97-'98.

In the earlier stages of general paresis, the physical signs are the most marked. Chief among them are: (1) the stammering or tremulous speech; (2) the tremor of the facial muscles and of the tongue; (3) the pupillary symptoms; (4) the change in the handwriting; (5) the exaggeration or the absence of the reflexes. The diagnosis, however, can only be established if some one or more of these signs are associated with mental symptoms. Any departure from the standard of thought and action that the individual has established for himself should always be regarded with suspicion, as should also any changes in his bearing that are not in keeping with his position in life. Defective judgment and especially defective memory are common changes. The early stages of the disease may be readily confounded with other conditions. The most common is cerebral neurasthenia. B. Sachs (N. Y. Med. Jour., July 2, '98).

The lines of expression in the face become obliterated in the later stages of paresis, but this sign can at times be noticed among the early symptoms on careful examination.

An early symptom is retention of the urine, which is due to loss of contractile power, or of reflex sensibility in the vesical walls. The overdistended bladder dribbles urine. This may be mistaken for a paralytic condition. In the advanced cases there is dribbling of urine and involuntary escape of fæces from relaxation of the sphincters.

An annoying symptom of cortical irritation is a constant grinding of the teeth. This is so often present in general paresis that it is considered by some authors as pathognomonic, but it also occurs in some cases of simple dementia.

The gait in the early stages is spastic or ataxic. In advanced cases it becomes slouching or dragging.

In the advanced stages, coincident with the progressive dementia, is increased motor debility. Tremors or twitchings give place to paresis and these again to complete paralytic conditions. The patient is no longer able to keep on his feet, and after a time he becomes bedfast. The power of articulation is lost and the voice becomes an inarticulate moan, extremely distressing to the hearer.

Mastication of food is forgotten and masses too large to pass down the œsophagus are partly swallowed and often cause asphyxia by compressing the trachea.

Vasomotor disturbances are frequent.

The innervation of the vessels is diminished and there follows dilatation of the superficial vessels, redness or blueness of the skin, œdema and cyanosis of the peripheral members, and diminution of blood-pressure.

The hæmoglobin and red corpuscles in general paralysis vary with the body-weight, the hæmoglobin, however, diminishing more than the red cells. They both decrease in the early stage, are stationary in the so-called second stage, and fall again in the third. Winckler (Inaug. Dissert., '91).

Literature of '96-'97-'98.

In general paralysis: 1. The hæmoglobin and red corpuscles are always diminished.

2. The specific gravity falls slightly below the normal.

3. Most cases show a slight leucocytosis, amounting on an average to about 22 per cent. above the normal. Early cases may have no leucocytosis whatever.

4. In the differential count a decrease is found in the lymphocytes along with a marked increase in the large mononuclear cells. The eosinophiles in a few cases are very numerous. J. A. Capps (Amer. Jour. Med. Sci., June, '96).

Sometimes there are punctiform extravasations of blood in the skin, and even actual hæmorrhages from the mucous surfaces, as from the bowel.

Consequent upon the defective innervation, combined with external mechanical influences (traumatisms, prolonged pressure, etc.), trophic changes occur. Othæmatoma and bed-sores are often noticed, the latter especially when the patients have become bedfast.

The course of general paresis is, as a rule, steadily progressive. Cases occur in which there are remissions, sometimes lasting for months, but, except in the earliest stages, when the diagnosis must be regarded as somewhat uncertain, no cases of permanent arrest of the disease have been recorded.

Literature of '96-'97-'98.

Changes that have appeared in the clinical picture of progressive paralysis of the insane in the last thirty years discussed. In 1880 was found 55 typical cases and 37 of the form characterized by dementia. In 194 cases observed since, the typical form occurred in 37 cases and dementia in 70 cases. The greater frequency of marked remissions also noted, many of the patients being able to resume their occupation from time to time, even after the physical signs had been pronounced. The disease, in spite of its milder character, appears to have become much more frequent, particularly among the women; the present proportion being about 4 men to 1 woman and, in cases developing early in life, the sexes are almost equally affected. Children are more frequently affected than formerly, and this appears to be due to the greater frequency of hereditary syphilis. Mendel (Neurol. Centralb., Nov. 15, '98).

The average duration of the disease is between two and three years. In some cases it has been known to continue longer, and cases are on record in which the duration is said to have been twenty years. On the other hand, it sometimes runs an acute course, ending in death in a few months.

Diagnosis.—Cerebral syphilis, tabes, chronic alcoholism, and cerebral neurasthenia must be differentiated from general paresis in its early stages. In syphilis there are more frequently symptoms referable to gross brain-lesions, ptosis, and other monoplegiæ, or more persistent hemiplegia than in paresis. At times the diagnosis is impossible during life. Tabes has strongly marked motor and sensory symptoms not usually present in general paresis, although they may complicate the latter.

As regards paresis, syphilis produces a pseudoparesis which is very hard to distinguish from true general paralysis. True general paralysis, where syphilis is but a concomitant element, or at best but a secondary cause, is not in the least influenced by specific treatment, while in syphilitic pseudoparesis a recovery may be anticipated if organic structural changes have not been produced. A. Morel-Lavallée (Gaz. des Hôp., Oct. 19, '89).

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Form of pseudogeneral paresis accompanying diseases of the liver. A sea-captain, of alcoholic habits subject to attacks of jaundice, was suddenly taken with difficulty in walking, and had an apoplectiform attack, following which he remained in an apathetic state, and had some motor disturbances of the tongue and lips, in the form of a suction movement. His speech was slow and rather scanning, similar to that of disseminated sclerosis. A diagnosis had been made of general paresis, with which the writer did not agree, as fibrillary twitchings of the tongue and lips were absent and the pupils showed no inequality. The examination of the urine showed the presence of urobilin, and a diagnosis was made of mental derangement secondary to disease of the liver.

This diagnosis was justified by the almost complete disappearance of the mental symptoms following an amelioration in the disease of the liver, and by the fact that a relapse of the mental condition occurred on the patient's relapsing into a condition of grave icterus, in which he succumbed. Joffroy (Gaz. Méd. de Paris, '96).

Chronic alcoholism sometimes presents symptoms resembling early general paresis, but the ocular symptoms of the latter are absent. The tremor and epileptiform attacks and mental manifestations are easily mistaken for the same classes of symptoms in general paresis. This is especially the case where the delusions are of the depressive form. In alcoholic insanity, however, there are more frequently delusions of suspicion, and, in married persons, delusions of infidelity on the part of the spouse, which may lead to criminal acts.

The insomnia, loss of memory, and hypochondriac sensations of neurasthenia may be mistaken for general paresis. In many cases it is only when the progressive character of the disease is noted that a positive diagnosis can be made. In neurasthenia delusions of grandeur do not occur, and, in place of the sense of well-being expressed by the paretic, the most minute details of physical symptoms are given. Thus, the neurasthenic can usually give an accurate account, with most wearisome details, of his gastric, abdominal, cardiac, or cerebral symptoms. The paretic, if he notices these at all, declares them of no consequence. Neurasthenia may be defined symptomatically, as a morbid sensitiveness, while, on the other hand, paresis is an abnormal lack of sensitiveness to morbid impressions.

A subject presenting the symptoms heretofore given, namely: persistent insomnia, with headache, a gradual change in his moral nature, loss of regard for public opinion; peculiarities in the psychical life, coming on so gradually as not to attract attention until opinions or acts more peculiar than usual are manifested; delusions, either of persecution, depression, or grandeur; irregular, dilated, or contracted pupils, with absence of the usual reactions to light and sensation; the persistence of the accommodation-reflex, heightened patellar reflex and attacks of faintness, attacks of unconsciousness or epileptiform convulsions should be viewed as a beginning case of general paresis. If the usual speech-defects characterizing this disease are present, the diagnosis may be regarded as reasonably certain.

In advanced cases of general paresis no difficulty should arise in diagnosis.

Causation.—General paresis — paretic dementia, general paralysis of the insane —is a disease of the middle period of life, rarely beginning before the thirty-fifth and still more rarely after the fiftieth years of life. Cases among children or in old persons are, however, not unknown. It attacks by preference persons in the higher walks of life, but among these is found especially in such as have more or less irregular habits. Syphilis is regarded by many authorities as the most prominent single cause, but cases frequently occur in which no evidence of syphilitic infection can be found. Mental stress, especially when associated with intemperance, venereal excesses, or other irregular habits are often found as precedent conditions and may perhaps be regarded as etiological factors.

Cerebral syphilis and general paralysis must be considered as two distinct affections, which may co-exist in the same person, but run their course independently from each other. There exists no observation which establishes without doubt that syphilis can produce general paralysis. Regnier (La Semaine Méd., Aug. 10, '90).

Among personal cases of paralysis about 80 per cent. of syphilitics found. General paralysis appeared about twelve or thirteen years after infection, and it appeared the sooner the less specific treatment there had been. Most of the syphilo-paralytics do not manifest the external signs of syphilis, and so it is with their descendants. On an average, the paralytic syphilitics are younger than the paralytic non-syphilitics, and among the syphilo-paralytics the youngest are those whose syphilis is the most recent. Régis (La Semaine Méd., Aug. 10, '90).

Paresis is essentially a disease of this century, and one which is increasing. In the tendency to mental overexertion and in excesses in *Venere et Baccho* are found important etiological factors. Krafft-Ebing (Wiener med. Presse, Nov. 17, '90).

The two most important etiological factors in precocious general paresis are heredity and congenital syphilis. J. Wiglesworth (Brit. Med. Jour., Mar. 25, '93).

Analysis of two hundred cases in Krafft-Ebing's clinic. Conclusion that syphilis is the chief cause of general paresis. Heredity seemed to be concerned in 11 per cent. of cases. Psychical causes could not be discovered. In 13 cases there was a history of traumatism, in 19 alcoholic excesses. Out of 175 cases with complete histories, 56 per cent. gave a positive history of syphilis, and 25 per cent. a probable history. In seventy-eight cases the period from infection to the symptoms of paresis varied from two to twenty-nine years. Hirschl (Wien. klin. Rundschau, No. 45, '95).

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In forty-one cases of paretic dementia in children, syphilis could be traced in 87.8 per cent. Zappert (Therap. Woch., iv, 289, '97).

Report to the Asylums Committee of the London County Council showing that in many cases of general paralysis there was usually a history of venereal infection, particularly in those cases of the tabetic type in which the dementia in the early stage was very slight. Lewis, of Claybury Asylum, investigated this point, and found that out of a total number of 200 males suffering from all forms of mental disease admitted to Claybury in 1897, 70 had suffered from venereal infection (including both soft and hard sores). Of these 200 cases 24 were general paralytics, and in 16 of them there were certain evidences of infection, doubtful evidence in 3, and no evidence in 5. Alcoholism was relatively infrequent as a cause. In 10 cases of juvenile general paralysis which Mott saw there were undoubted signs of congenital syphilis (Hutchinson's teeth, linear cicatrices, or interstitial keratitis) in no less than 8. Again, he found that atheroma of the aorta was comparatively frequent in general paralysis. Of 86 males dying under forty-six years of age.

24 had atheroma of the aorta; 60 of these cases were general paralytics, of whom 22 had atheroma, or 1 in 3, whereas the proportion was 1 in 13 for the other cases. Of 53 females dying under forty-six, 18 had atheroma; 18 of the cases were general paralytics, and of these 10 had atheroma, or more than half. It must be remembered that eminent authorities regard syphilis as the most important cause of atheroma of the aorta. Mott (Transactions of Asylums Committee of London County Council, '98).

General paresis is increasing in frequency, males being still more often affected than females. The disease appears to be more common in married men; thus, of 89 male patients, 64 were married, 17 single, 6 widowed, and 2 divorced. The disease apparently occurs almost exclusively among married women. Steinach (Med. Record, Dec. 17, '98).

It is more frequent in cities than in country-districts. Men are attacked from three to five times as often as women. The latter appear to be becoming more subject to the disease, as a few years ago the proportion in the two sexes was stated as one to seven. Clergymen are almost exempt, while actors and "men about town" are the most frequent victims.

Pathological Anatomy.—In general paresis we have a psychosis based upon recognizable structural alterations in the brain. These alterations are so disseminated that the entire brain undergoes a gradual loss of functioning power as a whole. The structural changes in the brain are found everywhere. The vascular sheaths are filled with white and red blood-corpuscles, the vascular walls thickened, and the calibre of the vessels diminished. In the substance of the brain there is an increase of the connective-tissue elements which, we have reason to believe, produce atrophy of the brain-cells by pressure. There is also frequently close adhesion between the arachno-pia and the surface of the brain. There is pretty constantly a disappearance of medullary nerve-fibres. At times there are minute hæmorrhages into the substance of the brain.

The arachno-pia is generally cloudy and thickened. The convolutions are diminished in volume and the fissures wider than normal. The cortical substance is decreased. The average diminution in weight of the brain amounts to 100 to 200 grammes (3 to 6 ounces).

Arachnoid and pia mater examined in a series of patients with general paralysis, pellagra, acute delirium, and other psychoses, particularly in the region of the central convolutions, where the meninges in general are first subject to alterations. In general paralysis the well-known vascular changes found; they were even noticed at the beginning of the disease, before there was any trace of sclerosis or atrophy of the cerebral substance. Chronic hyperæmia of the encephalon and the consecutive changes considered as primary anatomo-pathological symptoms of paralytic insanity. In the pellagrous lunatic the pia mater presents diffuse opaque alterations, a slight augmentation of the connective-tissue elements, and occasionally an infiltration of leucocytes, collected around the vessels or isolated in the meninges. In the other forms of insanity a slight thickening of the pia mater was usually noticed; the tortuous vessels had rigid walls, as in the case of very old people or in those dying of marasmus. The thickening of the pia mater usually began at the level of the central convolutions. Francesco del Greco ("Revista Sperimentale di Freniatria e di Med. Legale in Relazione con l'Antropologia e le Scienze Giuridiche e Sociali," Reggio-Emilia, '93).

There is a widely-pervading cell-degeneration of a granular, probably fatty type; overgrowth of the connective-tissue structure within the cerebral substance, and a diffuse, inflammatory change around the sheaths of the blood-

vessels, with slighter alterations in the sheaths themselves. It is regarded as very probable that the beginning of the disease is to be found in some alteration of the blood-supply, followed by a peri-arterial lymphoid growth, disturbance of the lymph-currents, consequent malnutrition of the nerve-structures. The skull is at times markedly thickened. In the medulla oblongata and the spinal cord structural alterations similar to those in the brain are found.

"Pathologists are not yet agreed whether the essential morbid condition in general paresis is inflammatory or degenerative: whether the changes occur first in the nerve-elements, the stroma, or the lymph- and blood- vascular systems. Berkley, one of the most recent observers, found degenerative changes, and then, when the nerve-elements begin to atrophy and disorganize, an overgrowth of the spider-cells, with other fixed cell-proliferation among the degenerating tissues: then follow the serous and sanguineous apoplexies and other incidental symptoms occasionally found."

Whether general paralysis is a disease *sui generis* or not, it is certain that the pathological appearances point to irritative (probably inflammatory) processes in the upper layers of the convolutions in the earlier stages, and to pressure signs from the presence of fluid in the later. T. Claye Shaw (Brit. Med. Jour., Nov. 16, '89).

The whole process of paresis starts in the vessels, and from these inflammatory changes take place in the neuroglia, which leads to destruction of nerve-fibres and changes in the ganglion-cells. General paralysis defined as an interstitial diffuse encephalitis. Mendel (Neurol. Centralb., Sept. 1, '90).

Attempts made to solve the much-discussed question, whether the degeneration of nerves in the progressive paralysis of the insane is dependent upon a primary degeneration of the vessels, by examining, from the same parts of the brain of paralytics, the capillaries for their condition and sections for degeneration of fibres. The results were, that in every spot where degeneration of capillaries were found degeneration of fibres could also be ascertained. Seven brains were examined, and it was found that the capillaries in the frontal convolutions were always degenerated. In the cerebellar cortex they were degenerated 4 times in 5 cases. In the occipital lobes the capillaries in 7 cases were healthy thrice, and those of the central convolutions, although only examined twice in either case, were found diseased. The cortex of the temporal lobe showed healthy capillaries once, diseased ones twice; that of the parietal lobe, diseased ones once and healthy ones twice. Paul Kronthal (Neurol. Centralb., Nov. 15, '90).

Wasting of the fibres with axis-cylinders in the gray substance of general paralytics (confirming the previous observations of Tuczet). Delicate fibres in middle layer of gray matter first to disappear. A. Meyer (Allgemeine Zeitsch. f. Psychiatrie, etc., B. 51, H. 4, '95).

It is probable that these primary nutritional disturbances are due to toxic influences.

In the depressive delirium which often precedes general paralysis, the sum of the waste-products eliminated in the urine descends below the physiological proportion. In the anxious delirium one observes, on the contrary, an increased amount of solids in the urine, in spite of the insufficient nutrition of the patients. In the last period, but not in the beginning, the carbonate of ammonium is found in the urine. Laillier (Le Bull. Méd., Aug. 15, '90).

Prognosis.—The general experience is that general paresis is incurable. The prognosis is, therefore, unqualifiedly bad. While the progress of the disease can be interrupted by appropriate management, no method of treatment is known by which it can be permanently cured.

Apparent recovery from general paresis after a residence in the asylum of six and one-half years. At the present time, nineteen years after the beginning of the disease, the patient is engaged in practice as a physician. It is admitted that there may be some traces of mental weakness remaining. Wendt (Schmidt's Jahrbücher, July, '89).

Acute confusional insanity is the only mental disease besides general paralysis which may cause death. The prognosis is worse than in mania or melancholia. The more complicated and changing the form, the worse the prognosis. J. Séglas (Archives Gén. de Méd., May, June, '94).

Treatment.—Obviously not much can be said about the treatment of a disease which, according to all observations, uniformly tends to a fatal ending. It is possible that an early recognition of the disease may lead to measures to arrest its progress. It must be confessed that at present our notions of such measures are extremely vague.

Complete rest from business and removal from all sources of irritation is the first object to be striven for. Dissipation, intemperance and venereal excesses must be abandoned. Removal to a properly managed institution as early as practicable is, therefore, to be urged. When the patient is at liberty and in control of money or possessed of credit, his expansive delusions will often lead him to the commission of acts which, while not dangerous, may be decidedly embarrassing to himself or others.

Antisyphilitic treatment may be of benefit even in those cases where there is no evident syphilitic taint. Mercury and the iodides, the latter in large doses, may cause arrest of the connective-tissue proliferation, and the absorption of the new formation in the brain and spinal cord. From ½ to 1 ounce of iodide should be given daily.

To combat the sleeplessness, chloral, bromides, sulphonal, and paraldehyde are indicated. In some cases, however, even excessive doses of these drugs fail to produce their beneficial effects. Opium may be cautiously tried, and will sometimes be effectual.

Marked success in checking the convulsive seizures of general paralysis by hypodermic injections of ergotinine, $^1/_{60}$ grain in solution. One or two injections are sufficient to check the convulsions. Christian (La Trib. Méd., Dec. 18, '89).

In general paralysis treatment must be guided not by the unfavorable prognosis, but by a conscientious endeavor to rescue the case. Many neurasthenics carefully treated are but general paretics in the earliest stages, saved before the fatal disease has a fixed hold. In cases of suspected paresis, the continuous ice-cap, ergot, and, in maniacal cases, injections of ergotine, the wet pack, sodium bromide, and, in proper cases, local blood-letting recommended. The iodides should be persistently tried, even in cases where a syphilitic history is not clear. Meynert (Zeitsch. f. Therapie, Aug. 1, '90).

Primarily, the patient suffering from paresis must be removed from his usual field of activity and strict quiet enjoined. Abundant, but easily-digested, food is to be prescribed. Iodide of potassium or sodium will be found useful, and, in certain cases, ergot. If a specific history is obtained, active antisyphilitic treatment is to be pursued.

For those cases that unfortunately get beyond the first stage the treatment is of necessity adapted to the symptoms. Krafft-Ebing (Wiener med. Presse, Nov. 17, '90).

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The treatment of general paralysis, as in the treatment of all mental diseases, is preventive and moral, as well as medicinal.

Preventive: The avoidance of marriage where a history of insanity is marked, the early recognition of the incipient stages of the disease, and the

avoidance of exciting causes, such as mental strain and excesses.

Moral: When the disease is recognized removal from home surroundings is of great importance, and a quiet out-door occupation the best suited to the bodily and mental health.

Medicinal: Bromides for excitement, and bromide combined with chloral if there is insomnia. In administering sedatives they should be combined with laxatives, and the combination of digitalis with bromides is most useful in relieving arterial pressure. Fletcher Beach (Clin. Jour., Apr. 6, '98).

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Encouraging results obtained in the treatment of paretic dementia by cold wet packs, always accompanied by cold to the head in the form of an ice-bag or wet towel. The duration of the pack is from one to three hours. The pack is followed by massage and sometimes by a brief douche. This treatment need not interfere with special treatment, such as iodide or mercurial inunctions.

The details of a cold or wet pack, as used in this treatment, are as follows: As many blankets are used as are considered necessary to produce a good reaction in the patient, placing one blanket above another smoothly spread out upon the bed; over all is placed a linen sheet wet in cold water and the patient is laid on that.

In wrapping the sheet about him care should be taken to separate adjacent parts, as arms and legs, from the body by folds of the sheet; then he is wrapped in the blankets, tucking closely fold by fold. The patient's head should be wet before he lies in the pack, and after he is comfortably placed in it a wet towel should be wrapped about his head unless an ice-cap is deemed better. If patient is very feeble and temperature of the surface subnormal more blankets will be required, or perhaps hot bottles at feet. Massage is usually given one-half hour after pack. In cases of active excitement the patient may be taken from the pack, rubbed or douched, and put directly back. If pyrexia is present it should be relieved by cool baths or short packs, with light covering, before the pack, above detailed, is given, otherwise the pyrexia is aggravated. Temperature should be taken twice day, and rise promptly met by ice to the head. Bowels should be carefully attended to to avoid autointoxication. Codding (Brit. Med. Jour., Nov. 13, '97).

Great care is necessary in feeding advanced cases to prevent bolting of large morsels of food, and consequent asphyxia from entrance of food into, or compression of, the air-passages. Attendants should be instructed how to remove masses of food from the œsophagus.

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In the treatment of choking among the insane manipulating windpipe upward from the outside will force food up into the throat so that it can be reached by the finger. R. M. Phelps (Jour. of Nervous and Mental Disease, Mar., '96).

In the paralytic attacks attention must be paid to regularly emptying the bladder and rectum.

Cleanliness and frequent changes of position in those patients who have become bedfast from the advance of paralytic symptoms will tend to avert bedsores. When these occur, the recognized surgical measures—namely: cleanliness, bathing with dilute alcohol, and removal of pressure—are indicated.

Finally, all measures tending to make the patient more comfortable, and less objectionable to his surroundings should be employed.

Catatonia.

Definition.—Catatonia is a form of insanity characterized by depression, exaltation, stupor, confusion, and dementia, usually occurring in regular cyclical sequence. There is also a spastic condition of the muscles and a tendency to rhythmical movements.

Symptoms and Course.—There is nothing peculiar about the prodromic, or primary, melancholic stage. There are the usual symptoms of mental and physical depression. Self-accusation and delusions of negation are not infrequent. Attempts at suicide are occasionally made. Refusal of food is frequent, but not usually persistent. Forcible feeding generally soon overcomes the reluctance to eat. On the whole, the melancholia does not appear to be so deep as in the ordinary cases of melancholia. It has a closer resemblance to the depressive phases of certain cases of general paresis.

In the maniacal stage there is restlessness with exaltation, varying with depression, delusions of grandeur, or fits of rage, culminating in attacks upon bystanders or in destructive tendencies.

Mutism, or dumb stupor, is usually present as a stage in the course of the disease. It may persist for long periods, or may be transitory. There may be absolute mutism or simply a refusal to answer questions. The patient sits or stands in one position, with head and eyes down, and apparently taking notice of nothing passing around him. Careful observation will show, however, that he often gives quick and watchful glances about and that he is not so deeply sunk in stupor as he appears to be. At times the patients mutter to themselves in a low tone, suffering nothing in their vicinity to distract them.

There is a generalized tension of the muscular system, in consequence of which the patient resists any change of position except such as he assumes voluntarily, or in which he has been placed. Thus, cataleptic states are not infrequent, although not so common as in hysterical conditions. The resistance to movement is probably always due to delusions of anxiety or fear, and is not uncommon in other mental disturbances, especially in melancholia and paranoia.

Among the somatic symptoms are othæmatoma, often anæsthesia, localized œdemas and other disturbances of nutrition. Loss of control over the sphincters is usually present. According to Kahlbaum, pulmonary phthisis is nearly always associated with the later stages.

Pathognomonic, in addition to some or all of the symptoms above mentioned, is a peculiar aberration of speech termed by Kahlbaum "verbigeration," and a rhythmical or stereotypic movement of certain groups of muscles. A spastic pouting or "*Schnauzkrampf*" is described as especially frequent. Other movements are the constant twisting, fraying, or buttoning and unbuttoning of the clothes, or the patient walks in definite limited lines or areas, not diverging from his regular path.

Verbigeration consists in the rhythmical reproduction of sounds, words, or sentences, often without logical connection, which are repeated in a declamatory or pathetic style. This verbal repetition is easily differentiated from the jabbering talkativeness or senseless rhyming mania of acute confusional insanity, or the drivel of advanced dementia.

In advanced cases consecutive dementia comes on, during which the stereotypic movements, verbigeration, and cataleptoid states may persist in a more or less modified form.

Causation.—While direct insane ancestry does not seem especially influential in the causation of catatonia, a neuropathic constitution, hereditary or acquired, is a usual precedent condition. Among other causes, masturbation is mentioned by authors as a frequent factor. While not denying the influence of this practice, the writer is not inclined to

attribute to it much weight in the etiology of the affection.

Diagnosis.— Stereotypic movements, muscular tension, and stupor are not infrequent in other mental disorders, especially in so-called acute dementia, paranoia, general paresis, acute hallucinatory delirium, grave hysterical conditions, and the insanities of pregnancy, the puerperal period, and of lactation. For a time these symptoms may simulate catatonia, but prolonged observation will show that they are merely incidents in the development of the particular psychosis in question, which is easily recognized in its further course. Most of the cases reported by American writers as catatonia are probably of this nature.

Prognosis.—This is unfavorable. Recovery rarely occurs. Most of the cases die of intercurrent phthisis.

Pathology.—This has not been sufficiently studied. The macroscopical appearances in the brain resemble those of general paresis.

Treatment.—This is essentially symptomatic.

Consecutive Dementia.

Definition.—Consecutive dementia is a state of permanent and incurable weak-mindedness following an acute psychosis.

Symptoms and Course.—In one hundred cases of acute mania or melancholia, from 50 to 75 per cent. will, under appropriate treatment, end in mental restoration; 10 to 12 per cent. will die of exhaustion or intercurrent somatic diseases; and the remainder will run into chronic mania or melancholia or into dementia. By this term is meant an alteration in the mental functions characterized primarily by enfeeblement of the psychical processes. The subject may recover sufficiently from the acute psychosis to properly perform mechanical labor of various sorts, particularly if he is prompted by some one, but consecutive thought, especially upon a complex subject, is impossible. Such persons are sometimes spoken of as having recovered with defective action of the brain, and many of the cases of mania discharged from hospitals as recovered are examples of such partial destruction of brain-power. He can continue doing his usual work, especially if it is mechanical and does not involve complex mental processes; but he is easily confused, is often irritable, may retain delusions or have hallucinations, and is altered in disposition in various ways. His friends will often remark that he is not the same since as before his illness, but it is often not easy to define exactly in what this alteration consists. In a more pronounced form of dementia there is great confusion of thought. Consecutive action as well as consecutive thinking becomes impossible. The dement of this stage may wheel a barrow, dig a trench, shovel sand, break stone, or chop wood with a good deal of energy, but every little while he stops, looks vacantly around, until his attendant calls to him, or until the repetition of some associative sight or sound calls up the remembrance of what he is doing, and of the necessity for "moving on." It is often extremely interesting to watch these mental paralytics at their occupation, and to note the breaks in the continuity of their mental processes.

Among the relics in all hospitals and asylums for the insane are many in whom the fire of maniacal exaltation has burned out. They lack all consecutive mental activity. To the loss of intellectual power and volition is added the failure of motor power. The subject has become a paralytic and sits or lies in bed, or on the floor, staring vacantly, taking no notice of his surroundings, passing urine

and fæces unconsciously, eating everything placed before him, or put into his mouth, and sometimes picking up and swallowing the most disgusting things.

Speech is often defective in consecutive dementia. It is slurring or lisping, and sometimes stammering, or syllables are cut off or dropped out of words. This may be due to structural change in the speech-centre or defect in the conduction of efferent impulses. At times there is mnemonic aphasia.

Diagnosis.—Consecutive dementia resembles in many respects idiocy and imbecility, from which it is easily differentiated by the history. General paresis rarely offers any difficulty, as the active delusions in this disease differentiate it readily from consecutive dementia.

Prognosis.—Consecutive dementia, being due to structural alteration in brain-tissue, is, in the present state of knowledge, incurable. It is often not actively progressive, and the dement may live in good physical health and weakened mental power for many years. In institutions for the insane tuberculosis finds most of its victims among the subjects of dementia.

Treatment.—This is purely symptomatic. Systematic employment and careful attention to nourishment and sleep will make most dements comfortable.

Senile Dementia.

Definition. — Senile dementia is a chronic, progressive weak-mindedness due to structural alteration in the brain occurring in advanced life.

Symptoms and Course.—As the physical powers decay with advancing years, the intellectual functions also become imperfect. There is in some cases a gradual alteration of the character of the person.

Memory of recent occurrences is usually impaired, while the recollection of past events is sometimes very detailed, if not exact. Old stories are told and retold without remembering that they were told before. The subject becomes suspicious of his relatives and friends, is easily excited and irritated, misplaces articles and, forgetting where they were placed, accuses others of stealing them.

Among the prominent symptoms are increased sexual desire, with diminution of power to perform the sexual act. The patient not rarely makes unseemly exposure of his person, and, as if conscious of his sexual incapacity, commits indecent assaults upon young girls.

The senile dement is obstinate and vain. He will not recognize the fact that his physical and mental powers are waning, but insists that he is as capable of conducting his business and other affairs as when in the prime of life. Thus, the doctor who is the victim of beginning senile dementia believes himself more capable than ever of attending to his professional duties, and resents the imputation that he is getting too old to do his work properly. The clergyman knows that he can and does preach better sermons than ever, and attributes the decrease in size of his congregation, if he notices it at all, to the influence of envious opponents who are endeavoring to lead his people away for selfish reasons. The story of the Archbishop of Granada in "Gil Blas" is an exquisite example of senile dementia.

Among the more striking physical symptoms are those associated with structural alterations in the central nervous system. There is usually a halting or lisping speech; the gait becomes slovenly or shuffling; there is loss of control over the sphincters, the urine and alvine evacuations passing into the clothing and bed unconsciously. There are also occasional slight paralytic strokes, sometimes with temporary loss

of consciousness. These are, however, generally quickly recovered from.

The sleep is usually disturbed, although in the later stages the opposite condition, a constant desire to sleep, may be present.

There is often a great tendency to stray away, requiring the patient to be constantly watched.

Senile dementia is rare before the sixtieth year. Its course is usually slow, running over several years. Striking improvement is sometimes observed, though it is rarely permanent. In the later stages when the patients are confined to bed, there are often large bed-sores, which increase the difficulty of treatment.

Diagnosis.—The history of the case is usually sufficient to prevent mistake. Some tardy cases of general paresis may be confounded with senile dementia, but a short period of observation should be sufficient to make a definite diagnosis.

Literature of '96-'97-'98.

The causation of senile insanities considered as those so remote as to have been beyond control, those in action in earlier periods of life, and those in action when senility is impending. Under the second class, which are within the range of medical direction, are principally the causes of vascular change and premature senility of the arteries. These are chronic alcoholism, syphilis, gout, rheumatism, venereal excess, great and prolonged physical strain, intense and long-continued mental application, with anxiety of worry and lack of self-control. Ralph Lyman Parsons (Med. Rec., Oct. 10, '96).

Reports on 192 autopsies in two years. In a large number of senile dements the fundamental cause consisted in atheromatous degeneration of the cerebral blood-vessels and in the frequently resulting atrophy of the brain. These anatomical changes stand as the basis of senile dementia. Adolf Meyer (Path. Report, Ill. East. Hosp. for the Insane, '96).

1. The rate of loss in brain-weight in chronic insanity is dependent upon the duration of the dementia.

2. The onset of senility is attended with an increased loss in brain-weight.

3. The pathological evidence of incipient dementia (beginning loss of brain-weight) suggests that the onset of chronicity occurs at an earlier period of a psychosis than the clinical symptoms would lead us to believe. W. L. Babcock (Phila. Med. Jour., June 18, '98).

Prognosis.—This is unfavorable. Recovery of normal mental function never takes place.

Treatment.—The treatment is symptomatic. The patient needs constant care to keep him clean, to prevent straying off, and to avert injury likely to result from his carelessness.

When there is defective circulation a mild stimulant may be useful. Sleep is best induced by malt liquors, paraldehyde, trional, or opium. Chloral should be avoided on account of its depressing effects.

Epileptic Dementia.

Definition.—A form of dementia occurring in advanced stages of epilepsy, due to structural alterations in brain-tissue.

Symptoms and Course.—A large proportion of epileptics are attacked by a secondary dementia, which is usually progressive.

In the early stages there are frequent outbreaks of violence, which may be due to hallucinations or delusions. The epileptic dement is often extremely dangerous from the sudden and unprovoked character of the violent outbreaks. He is usually quarrelsome with the weak and peaceably inclined, but soon acquires a wholesome respect for those who strike back. He usually makes constant complaints, often false, of ill-usage on the

part of others. Untruthfulness is so frequent among epileptic dements that it may be almost regarded as a characteristic.

In advanced cases the failure of the mental and physical powers becomes very noticeable. The speech is affected and control of the sphincters is lost. Most patients die in *status epilepticus*, intercurrent pneumonia, or exhaustion.

Treatment.—All epileptic dements should be placed in appropriate institutions on account of the danger from outbreaks of violence. The usual remedies for epilepsy may delay the progress of the dementia, but no hope of arresting it can be entertained.

Group V. Psychoses due to Gross Lesion in the Brain.

Under the term *organic dementia* authors describe those forms of insanity due to destruction of areas of brain-tissue following syphilitic deposits, abscesses, hæmorrhagic infarctions, tumors, aneurisms, and cranial traumatisms.

Syphilitic Insanity.

Definition.—Insanity due to syphilitic new formation in the brain or meninges.

Symptoms. — Severe and long-continued headache, more intense usually at night, frequently precedes any psychical manifestations. Attacks of unconsciousness, sometimes convulsions and coma, are not rare. After one of these attacks there is frequently local or general paralysis, which may be transitory or permanent. Ptosis is a frequent symptom. Halting speech and actual aphasia may also occur.

Stupor and depression may alternate with maniacal outbreaks. The memory is often profoundly impaired, the patient forgetting even his own name, business, and place of residence. In many cases the symptoms resemble so closely those of general paresis, including delusions of grandeur, that a differential diagnosis is impossible during life. In most cases, however, the motor disturbances are of a more distinctly paralytic character, complete loss of power of certain muscular groups being more frequent than in general paresis.

In advanced stages the dementia is usually profound.

Diagnosis.—This must depend largely upon the history. The presence of evidences of syphilis in other organs; sudden attacks of aphasia, following apoplectic or epileptiform seizures; hemiplegia and ptosis, with the psychical symptoms above mentioned, will permit a probable diagnosis to be made in the majority of cases. As stated, however, a positive differentiation from general paresis is often impossible during life.

Literature of '96-'97-'98.

Conclusions based on a study of syphilis in its relation to insanity summed up in the form of a suggestion for a provisional scheme of classification as follows:—

I. Insanity of early syphilis (primary and secondary).
   1. Acute toxic insanity (analogous to delirium or mania a potu).
   2. Melancholia with or without dementia, probably due to cerebral anæmia.

II. Insanity of late (tertiary) syphilis.
   1. Insanity due to syphilitic disease of the base and vessels.
   2. Insanity due to syphilitic disease of the convexity.

Most, if not all, cases of cerebral syphilis in which insanity has been caused by epilepsy will fall under the second head (II, 2), but should rather be classed with epileptic insanity, being only indirectly due to syphilis.

III. Metasyphilitic (parasyphilitic) insanity.

1. Insanity of tabes (so far as due to other than "moral" causes).
2. General paralysis of the insane.

This classification only includes cases in which there is certainly, or probably, a gross anatomical change at the basis of the mental symptoms. But it is obvious that there are various indirect ways in which a disease like syphilis may produce morbid action in unstable minds. Such are the fear of contracting the disease; the worry, remorse, and anxiety produced by its existence; and the pain and insomnia and other sensory symptoms so common in its course. With this class of cases, as being but the indirect result of the disease, and in no way peculiar, no attempt has been made to deal. W. R. Dawson (Jour. Mental Science, Apr., '98).

Pathological Anatomy.—The syphilitic neoplasm may be in the form of a diffused gummatous meningitis, endarteritis, or gummatous foci in the brain. Meningitis may also result from gummatous osteitis of the cranial bones.

Prognosis.—In the early stages if appropriate treatment is promptly instituted the prognosis is not unfavorable. If, however, the morbid process has advanced, and brain-tissue has been destroyed by the neoplastic infiltration, or by the endarteritic process, no hope of restoring the normal condition can be entertained.

Treatment.—Mercurial inunction and potassium iodide in large doses should be employed as soon as a probable diagnosis is made. The iodide may be given in doses of $^1/_2$ to 1 ounce daily, pushing it to the limit of tolerance. The effects of mercury must be watched, and care taken to keep the patient's nutrition at a proper standard. Ferruginous tonics will generally be required.

In paralytic cases the development of bed-sores should be carefully guarded against.

Post-apoplectic Insanity.

Definition. — Insanity following destruction of an area of brain-tissue, due to cerebral hæmorrhage or embolism.

Symptoms.—In addition to the usual physical symptoms following gross brain-lesions,—aphasia, hemiplegia, etc.,—there are loss of memory, dementia, and occasional attacks of emotional disturbance or outbreaks of maniacal violence.

Treatment.—This can only be symptomatic. Securing good nutrition and sleep, guarding against bed-sores, keeping the patient as comfortable as possible, is all that can reasonably be striven after. Mental restoration is not to be expected.

Insanity from Cerebral Tumors and Abscesses.

In many cases of brain-tumor or brain-abscess no psychical symptoms are present. In others, however, there is loss of memory, apathy, dullness of perception, occasionally of intellectual perversion. Hallucinations and delusions may be present. When the neoplasm encroaches upon the visual sphere, hallucinations of vision may complicate loss of sight. In one case of a large abscess in the occipital lobe there was almost entire loss of vision, with delusions of personality, probably depending upon visual hallucinations. Christian and Raymond have reported cases of hallucinations of vision apparently depending upon intercranial growths.

Treatment.—Obviously the only treatment that can be considered is palliation of the symptoms and surgical interference.

Insanity from Cranial Traumatism.

Insanity follows cranial injuries much more frequently than is commonly supposed. The delirium attending concussion of the brain or traumatic meningitis may be ignored here entirely as appertaining entirely to surgery. But many

of the cases recovering from the acute mental disturbances following shock and inflammation later become permanently insane.

> Over 36,000 clinical histories examined with the view of determining whether there is such a form as traumatic insanity or whether the psychical disturbances following traumatism only exceptionally present characters of a special psychosis in the stricter sense of the term. There were found 23 females, 6 still living, and 102 men, 23 of whom were still under treatment. In 28 cases there was an heredity; in 97, none. The prevalent form of injuries was a fall on the head. In both sexes the consequences were epilepsy, melancholia, dementia, mania, imbecility, and moral insanity. The psychical phenomena appeared in some cases a few days after the injury, and in others their first appearance varied from a few months to a few years. Gonzales (Archivio Ital. per le Mal. Nervose e più Partic. per le Alien. Mentale, Milan, '92).

It has been pointed out by Sir J. Batty Tuke and others that a condition closely resembling, if not identical with, general paresis follows injury to the brain.

> [A case of this sort is at present under my observation. The patient, a painter, sustained a severe shock by falling from a scaffold and striking upon his head. Unconsciousness and delirium continuing for ten days succeeded the injury. On recovering consciousness there were delusions of grandeur, which lasted for nearly a year, gradually becoming less marked. The pupils were for a long time contracted and fixed, not reacting at all to light and pain and only very slightly to accommodation. After a year the expansive delusions disappeared and there remained a moderate state of dementia, which appears stationary.
>
> Localizing symptoms of focal disease have never been present. GEORGE H. ROHE.]

Treatment.—In cases of fracture of the skull the recognized surgical procedures are indicated. In contusion, opening of the skull at a point opposite to the site of injury will often show evidences of inflammation of the meninges and contusion of the brain. It is probable that trephining and drainage would here sometimes prevent the subsequent development of insanity.

> Insanity due to injuries of head of rather infrequent occurrence. Two cases in which cure followed trephining. Cale (N. Y. Med. Jour., Oct. 12, '95).
>
> Case of insanity and epilepsy nineteen years after causative injury. Trephining followed by complete recovery. Binet and Rabatel (Lyon Méd., May 12, '95).

In the secondary dementias following brain-injuries, operative procedures, unless demanded by focal symptoms, are not likely to be beneficial.

> Trephining cannot as yet be reckoned among methods of treatment. Excision of parts of cortex seems altogether unacceptable. Semelaigne (Annales Méd.-psychol., May, '95).

GROUP VI. PSYCHOSES DUE TO TOXIC SUBSTANCES CIRCULATING IN THE BRAIN.

In this group are brought together not only those cases in which the cause can be clearly attributed to a poison circulating in the blood,—such as alcohol, lead, and drugs (salicylic acid, opium, cocaine),—but also those which are believed to be due to autogenetic or infective toxins, such as puerperal and surgical sepsis, uræmia, the toxins of influenza, typhoid fever, pneumonia, insolation, etc.

The type of all the different toxæmic psychoses is that described by different authors under the names "acute delirium," "acute delirious mania," "delirium grave," "acute hallucinatory confusion" and numerous other synonyms, but which will be here considered under the name suggested by H. C. Wood,

"Acute Confusional Insanity." The general description will indicate the type, while variations will be mentioned under the specific forms.

Acute Confusional Insanity.

Definition.—An acute form of mental disturbance, beginning suddenly or with few prodromes, characterized by incoherence and confusion of thought, excitement, or at times stupor, hallucinations, fever, and a tendency to exhaustion.

Symptoms.—Headache and insomnia may precede the outbreak. Usually, however, the only noticeable prodromic symptom is a state of irritability or anxiety. In most cases the patients suddenly become excited, talkative, have hallucinations or illusions, which are rarely of an agreeable character. They may see rats, snakes, spots of blood, etc. The visual hallucinations are often like those of delirium tremens, so graphically described by Kerr in the first volume of this CYCLOPÆDIA. Auditory hallucinations may also be present, but are infrequent. The hallucinations and illusions are usually of a changeable and fleeting character. Sometimes there are delusions of suspicion and persecution, and occasionally delusions of grandeur. The patient soon becomes incoherent, loses all relation of time and space, does not recognize his surroundings, and confounds his own and others' personality. There may be sudden outbreaks of violence, which sometimes lead to homicidal acts, as in cases of puerperal and alcoholic insanity. The hallucinations and illusions are sometimes of an erotic character.

Temporary lucidity may occur, but is usually transitory.

Some patients are excessively loquacious, chattering senselessly all the time, making nonsensical rhymes, or repeating a great number of words having a similar sound. Thus, a remark that the patient looks bright will lead to a string of words like: "bright, light, sight, tight, fight, night, kite," as if read from a rhyming dictionary. At times the patient makes new and often bizarre words. This is perhaps a form of amnesic aphasia. At other times there is mutism with muscular rigidity, the patient being apparently in a cataleptic condition.

Frequently there is great motor restlessness. The patient is kept in bed with difficulty, and, if allowed to get up, runs about the room or ward, shouts, laughs, pounds against doors, breaks windows and furniture, and tears his clothing. He does not control his sphincters and passes urine and fæces into the bed and clothing.

There is usually fever, with rapid, and, in advanced cases, feeble pulse. The tongue is dry and coated, there is loss of appetite and frequently refusal of food, although this can usually be overcome without resort to forcible feeding.

Causation.—Probably toxæmia in all cases. The poisonous materials may be absorbed from the intestinal canal, from wounds or septic areas, or may be formed in the blood, tissues, or glands. They may be autogenetic or introduced from without. In some cases (Rasori, Kyle, Babcock) organisms have been found, but their specificity has not been demonstrated.

Acute confusional insanity occurs during or after infectious diseases (typhoid fever, influenza, pneumonia, rheumatism); after surgical operations, in the puerperium, during lactation, after cranial and other traumatisms, neuritis; from the ingestion of alcohol, opium, cocaine, lead, and other drugs; from the inhalation of certain poisonous gases,—sulphide of carbon, sulphuretted hydrogen, etc. Cerebral exhaustion, fright,

anger, and other psychical shocks are also said to cause this form of mental disturbance.

> Specific infection must be included among the causes of mental symptoms and diseases which precede, accompany, or follow febrile and other infectious disorders. Much negative evidence may be adduced in favor of acute delirium or acute mania's being due to toxæmia. Analogies with nervous affections, known or believed to be of microbic origin, favor the view that insanities with similar or related phenomena and lesions are also microbic in origin. The meagre evidence afforded by careful bacteriological investigation of cases of acute insanity seem to show that various micro-organisms may induce the same or similar types of mental disease. The mental disorders of pregnancy and the puerperal state are, in a considerable proportion of cases, probably toxæmic, without reference primarily to childbirth; but it cannot be regarded as proved that a bacillus of either eclampsia or puerperal mania is the sole cause of these affections. C. K. Mills (N. Y. Med. Jour., June 23, '94).

Diagnosis.—The differentiation must be made from mania and melancholia. The affection is frequently confounded with the former. Many cases pronounced mania, even by expert alienists, belong to the group of acute confusional insanities. Pure mania—that is, typical exaltation without incoherence—is not as frequent as it would appear to be from statistical tables. Worcester puts the matter very clearly when he says "there are two distinct classes of cases, which have in common the symptoms of motor restlessness, loquacity, destructiveness, and violence. In the one (mania) there seems to be, at the outset at least, an exaltation of some of the mental faculties. The patients appreciate perfectly well their surroundings; perception seems preternaturally acute; memory appears to be quickened, so that long-forgotten circumstances are related with the utmost accuracy. The patients show an extraordinary quickness in repartee, and often a diabolical ingenuity and cunning in mischief. They are always ready with an ingenious and plausible explanation of their extravagant conduct. The elation which is present is the natural reflex of the feeling of unbounded, unimpeded energy. Hallucinations are seldom, if ever, present; delusions may be entirely wanting, and, if they exist, they are the natural expression of the emotional state. In the other class, on the contrary (confusional insanity), there is, from the beginning, evident intellectual impairment, which may exist in any degree, even to an entire failure to rightly recognize any of the persons and things about the patient. Memory is impaired or practically abolished; the acts of mischief and violence are done without any apparent purpose, and, when any explanation of them can be obtained, it is utterly irrelevant or evidently founded on some preposterous delusion. Hallucinations are extremely common, and, with vague, incoherent delusions, dominate the whole conduct of the patient. As a rule, there is no evidence of any feeling of elation.

"The distinction between melancholia and confusional insanity, with depression, is of the same sort. The disorder in melancholia is primarily emotional. The patients appreciate perfectly their surroundings, they recognize persons and things; they can reason correctly on topics indifferent to them if their attention can be fixed upon them; their delusions are the expressions of the overpowering feeling of impending evil, which makes everything inconsistent with it seem incredible. In confusional insanity, on the contrary, when there is the feeling of depression, it is the result

of the delusions, which are vague, incoherent, and illogical."

Many of the cases pronounced "agitated melancholia" and "melancholia with stupor" are doubtless cases of confusional insanity.

Prognosis.—The prognosis of acute confusional insanity is generally favorable. While a considerable proportion die from exhaustion under the customary methods of treatment, the number passing into dementia is comparatively small. The recovery-rate should be, under favorable conditions (early treatment, careful nursing) at least 75 per cent. The greatest danger is from exhaustion.

Treatment.—The tendency to exhaustion being an ever-present one in acute confusional insanity, the first and most important requisite in the treatment is rest in bed. Isolation is not necessary, and, in the opinion of the writer, not desirable. Patients may at times be treated successfully at home, but where an institution is accessible, the chances for recovery are better if the patient is removed to one.

Nutrition demands constant attention. Easily-digested food in sufficient quantity must be provided, and the physician should satisfy himself that the patient gets it at the proper times. Forcible feeding is rarely necessary, but many patients require urging to eat. Such a one is liable to suffer in the hands of a careless nurse or attendant. Stimulants are often necessary, especially in cases with much fever.

The insomnia and delirium can often be overcome by warm baths, but if the usual hygienic means of producing sleep fail, hypnotics must be resorted to. Of these, opium is to be preferred, on account of its stimulant properties. Chloral, hyoscine, and paraldehyde are not recommended, the former on account of its depressant effect upon the heart, and the two latter because they interfere with nutrition. Next to opium, sulphonal and trional may be cautiously tried. Digitalis, strophanthus, and strychnine are often of great value to tone up the depressed heart. The bowels should be kept open by mild saline purgatives.

Tincture of chloride of iron in large doses is often of value. Under proper management, recovery is often remarkably rapid. All sources of toxæmic infection should be sought for, and if possible removed.

Puerperal Insanity.

Definition.—Mental disturbance occurring in the puerperal period, due to toxæmic infection. The clinical form of the disease is usually acute confusional insanity.

Symptoms and Course. — The symptoms of puerperal insanity are usually those of acute confusional insanity. The outbreak of the disease usually occurs in the first week of the lying-in period. It is in almost all, if not in all, cases related to certain well-known symptoms of puerperal sepsis. Fever is nearly always present. Changes in the quantity and character of the lochia are frequent. There may be prodromic symptoms, although usually these are not well marked. This consists either in depression, irritability, or emotional instability. The outbreak usually begins with excitement, rapidly ending in incoherence. The usual feelings are perverted. The patient may have attacks of violence during which attempts are made on the life of the husband, the newly-born child, or other children, if there are any. These attempts often have a religious basis: at other times they are based upon delusions of jealousy.

Not infrequently the hallucinations

and delusions of the patient are of a sexual character. The most refined women will surpass the imagination of the veriest rake and gutter-snipe in their obscenity and vulgarity of language and action.

Motor excitement is common. There is frequently a tendency to remove the clothing. In some this appears to be a desire to expose the body to view; in others it probably is due to an hallucination of common sensation, rendering the weight or pressure of the clothing unbearable.

A second stage following this excitement is often one of depression. The distinction from true melancholia is, however, easy. The patient gets apathetic, there may be depressive delusions, suicidal tendencies may develop, and there may be alternations of excitement and depression, with incoherence as a dominant symptom, lasting for years. While cases end not infrequently in secondary dementia, this is not frequent. The writer has seen an apparently complete recovery from puerperal insanity after six years' residence in an asylum.

The stuperose stage of confusional insanity is usually passed through by puerperal cases on the way to recovery or dementia.

Diagnosis.—The diagnosis of puerperal insanity cannot be made from the symptoms. It is not a special variety of insanity symptomatically, but etiologically. The cases of insanity occurring early in pregnancy, which are so often classed with the puerperal insanities, have generally no etiological relation with them. On the other hand, cases of lactational insanity frequently belong to the same class of toxæmic psychoses.

Causation.—As stated in the definition, the writer believes puerperal insanity to be due to toxæmic infection. The reasons for this opinion are the following:—

1. Puerperal insanity occurs, in the great majority of cases, within the first ten days after delivery—about one-half in the first five days—the same period during which puerperal infection usually occurs.

2. It is usually accompanied by elevation of temperature and other evidences of febrile disturbance.

3. The clinical form in which puerperal insanity manifests itself is, in the majority of cases, that of acute, delirious, or confusional mania. Depressive states are rare except as secondary forms. In other words, the most frequent condition is one most closely resembling febrile delirium.

4. The death-rate is much higher than in simple mania. Death occurs from exhaustion, usually with high temperature and rapid pulse.

5. Post-mortem examinations, though apparently infrequent in these cases, have shown grave involvement of the pelvic viscera.

6. Examinations of the pelvic organs during life show lacerations of the perineum and cervix uteri (facile channels of infection in the puerperal woman). As secondary conditions are found intrapelvic (peritoneal) inflammations, and consequent abnormal locations, fixations, and congestions of the uterus, tubes, and ovaries.

> Puerperal infection is the direct cause of puerperal insanity. Out of forty-nine cases, well-marked evidence of puerperal infection was found in forty-two, while of the remaining seven two were complicated with eclampsia, the mental disturbance being transitory. Twelve of the cases proved fatal. T. Hansen (Centralb. f. Gynäk., No. 20, '88).

> Puerperal insanity is not a true etiological species, but only an active, de-

lirious phase of mental degeneracy and a neuropathic tendency. The hereditary taint and morbid predisposition are the true cause of the disease, the puerperal condition being only its immediate and exciting cause. Out of 133 cases cited, 21 began during pregnancy, 55 followed parturition, and 57 occurred during lactation. Z. Gorsky ("Considérations sur la Folie Puerpérale et sur sa Nature," Thèse de Paris, '90).

Prognosis.—The prognosis of puerperal insanity is favorable: 75 to 80 per cent. recover, but a large proportion of the remainder die of exhaustion.

In no class of cases of insanity is the prognosis so favorable as in those of puerperal origin.

The number of previous pregnancies seems to have little influence, but the age seems of more importance; the younger the patient, the better, apparently, is the prognosis. J. E. McCuaig (Med. News, Nov. 16, '95).

Treatment.—The principles of treatment indicated under acute confusional insanity are in place here. Bed-rest, good food, and hypnotics when necessary are the indicated remedies.

Bearing in mind that puerperal insanity is an infection psychosis, the local sources of infection should be sought out and removed if possible. In some cases there is simply sapræmia due to absorption of septic materials from the birth-canal. Here the use of douches of hot water, medicated with antiseptics or not, are in order. In cases of purulent endometritis curetting of the interior of the uterus with repeated irrigation or gauze packing will be required. In cases where tubal, para- or peri- metric inflammatory disturbances have occurred, the proper procedure has always seemed to the writer to be the operative removal of the foci of infection. Even in cases of long standing (two to five years) the operative removal of local sources of irritation and infection has resulted in entire cure of the mental disturbance.

Lactational Insanity.

Definition.—Mental disturbance occurring during the period of lactation, usually coming on from six weeks to ten months after labor. Prevailing types: confusional insanity and melancholia.

Symptoms and Course.—In the depressed cases all the phenomena of melancholia are usually present. Frequently there is simple depression without hallucinations or delusions. Suicidal tendencies are frequent.

The cases usually described as maniacal belong, in the majority of instances, to the acute confusional type. There are varying hallucinations and delusions, incoherence, refusal of food, generally fever, want of control of the sphincters, and a tendency to exhaustion.

Etiology.—Prolonged or excessive lactation is given as the chief cause of insanity occurring during the nursing period. Careful inquiry will, however, show that certain conditions favoring toxæmic infection are often present. Thus, a mammitis or mammary abscess not rarely precedes the mental disturbance. Defective uterine involution is regarded by Bevan Lewis as a factor. The writer has found lacerated cervix and endometritis present in some cases.

Diagnosis.—The occurrence of confusional insanity during the nursing period is the only diagnostic feature. There is nothing distinctive in the symptomatology. Between 3 and 4 per cent. of all cases of insanity in women occur during the nursing period.

Prognosis.—Moderately favorable. From 40 to 50 per cent. recover. Clouston claims as high a proportion as 77 per cent.

Treatment.—Removal of local sources of infection or irritation. Good food and

hæmatic tonics are usually indicated. Arrest the drain upon vital power by stopping the nursing.

Saturnine Insanity.

Definition.—Insanity following the absorption of lead.

Symptoms and Cause.—Two forms of insanity from lead are described. In the one the patient is incoherent, but not very much disturbed. In the other there is violent, noisy behavior with incoherence, followed by deep sleep or coma. Tremor and subsultus tendinum are usually present. At times there are epileptiform convulsions.

Diagnosis.—The usual objective signs of lead poisoning are present.

Prognosis and Treatment.—The disease is extremely grave. About one-fourth of the cases die in the attack. Dementia may follow in cases escaping death. The majority of cases recover with or without mental defect. The treatment is that of lead poisoning.

Uræmic Insanity.

Definition.—Insanity occurring in the course of Bright's disease and due to the non-elimination of toxic materials from the blood.

Symptoms and Course. — Christian, Alice Bennett, Bondurant, Tuttle, Babcock, and others have shown statistically that a large proportion of the insane in hospitals and asylums in this country have chronic renal disease. Irrespective of the general etiological significance of this fact is the occurrence of cases of insanity in the course of chronic Bright's disease and probably depending upon the same causative factors as other symptoms of uræmia. In a recent case observed by the writer there were depressive symptoms alternating with delusions of persecution; so that the diagnosis had, at different periods, fluctuated between melancholia and paranoia. The case terminated in uræmic convulsions with amaurosis. Maniacal delirium sometimes occurs. Clouston refers to cases of violent uræmic delirium, ending rapidly in death. This CYCLOPÆDIA (see BRIGHT'S DISEASE, volume i) contains abstracts of a number of cases that show the varying symptomatology.

Systematic examination of the urine should be part of the routine in all examinations of insane persons.

> Satisfactory clinical observations, together with post-mortem findings, clearly demonstrate the occurrence of pronounced insanity as a result of all forms of kidney inflammation as well as other renal disorders. In a great majority of these cases the mental disorder is to be attributed to uræmic intoxication. There is no special form of insanity from renal disease, though the different forms of melancholia are those most frequently observed. Auerbach (Allgemeine Zeit. f. Psych., etc., B. 52, H. 2, '95).

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> Only 2 cases of uræmic insanity seen among 3000 carefully observed lunatics. It appears, however, that uræmia, both acute and chronic, may lead to insanity. E. Bischoff (Wiener klin. Woch., No. 25, '98).

Treatment.—In addition to the usual remedies for the uræmic condition, morphine is often necessary to quiet restlessness and delirium.

Post-febrile Insanity.

Definition. — Insanity arising in the course of or following infectious diseases.

The ordinary febrile delirium is not included here, although probably depending upon the same essential cause: *i.e.*, a toxæmia.

> [Sydenham, over two centuries ago, described delirium and comatose stupor occurring in the course of small-pox. He also referred to "a sort of mania which succeeds long-continued intermittent fevers and at last degenerates into

idiocy." Here is evidently meant, not a transitory delirium, but a prolonged acute psychosis terminating in dementia. In the light of our present knowledge, the explanation of Sydenham—"this comes from weakness and vapidity of the blood brought on by over-long fermentation"—seems almost prophetic. Benjamin Rush mentions "fevers of all kinds" among the causes of insanity, and refers specifically to one case following measles. Murchison refers to cases of mania and imbecility following typhus and typhoid fevers. In 1880 Kraepelin collected over four hundred cases of insanity occurring in connection with febrile diseases. GEORGE H. ROHE.]

Insanity has been observed during the course of or following typhoid, typhus, and malarial fevers, small-pox, measles, erysipelas, rheumatism, gout, cholera, and influenza. The last-named disease has preceded insanity in a large percentage of cases occurring within the past nine years.

It is a comparatively rare occurrence for actual insanity to develop during the course of bodily disease. Mental disease most commonly occurs after fevers, poisons, injuries and operations, and heart disease, and perhaps in this order of frequency. In the early stages of fevers and after injuries and operations, mania is the common form of insanity, but in other conditions depression is more common, though the commonest form is an insanity with marked delusions of persecution, often associated with auditory hallucinations. There is no special form of insanity connected with special bodily disease with the exception of the condition which accompanies alcoholic paralysis, and which is marked by a pronounced failure of memory for time and also for place. Insanity occurs with unusual frequency in bodily diseases associated with peripheral neuritis, as in poisoning by alcohol or carbon monoxide. Where the cause is not continuous the mental symptoms in the great majority of cases disappear. Reynolds (Jour. Mental Sci., Jan., '94).

Symptoms and Course.—The clinical forms of mental disturbance described as following febrile diseases may be confusional insanity, melancholia, and mania. Purely exalted conditions seldom occur. When there is melancholia, it is usually associated with hallucinations and delusions. The hallucinations and delusions of the acute stage often persist in the stage of dementia.

[I have known a case of confusional insanity following erysipelas in which, seven years after the acute outbreak, the hallucinations of hearing and delusions of persecution and personality are present in their original force. In a case of depression following influenza delusions of personality with persistent mutism (not stuporose) still remain, five years after the beginning of the attack. Thayer has reported a case following typhoid fever in which there were depressive symptoms with hallucinations of sight and hearing. GEORGE H. ROHE.]

Incoherence with hallucinations, illusions, and delusions are usually marked symptoms of post-febrile insanity. In heavy drinkers a violent maniacal delirium sometimes occurs during the height of the febrile process.

Febrile delirium, during an infectious disease, is an acute attack of insanity. There are the febrile mental derangements proper to the fever (*psychoses fébriles*), and there is the delirium of convalescence (*psychosis asthéniques*). Toward the end of acute infectious diseases there is the "delirium of inanition," which may go on to the delirium of collapse. Weber (Medico-Chirur. Trans., '65).

Though asthenic delirium is the most common kind during convalescence, other kinds are met with, sensorial illusions being often present. There is, probably, in such cases, a cerebral intoxication due to microbic products of the virus which has set up the disease. One great distinction between the psychoses of convalescence and the delirium of fever lies in the evident influence of heredity, and the personal antecedents of the patient, upon the character of the

delirium in the former case (Kraepelin, Savage), in contrast to its uniform course in the latter; in fact, heredity appears to play the chief part, and the acute disease is often only the accidental cause of the mental alienation. Christian (Archives Gén. de Méd., Sept., '73).

Two cases complicating pneumonia have come under my notice. Clouston has laid especial stress upon the mental depression succeeding influenza. He says the last epidemic "left the mental and nervous tone of Europe lower by some degrees than it found it," and "no epidemic of any disease on record has had such mental effects." However true this may or may not be of Europe, there is, in my opinion, no evidence that similar disastrous effects have followed the epidemic in America.

Prognosis.—This is usually favorable. If the patient escapes the dangers of exhaustion in the acute stage, recovery takes place in from 70 to 80 per cent.

Treatment.—The treatment of post-febrile insanity usually requires careful attention to the nutritive functions. Tonics and stimulants are nearly always indicated. When hypnotics are necessary, the depressive drugs—chloral, bromides, sulphonal—should be avoided. Opium and cannabis Indica are often of great value.

Post-operative Insanity.

Definition.—Insanity following, immediately or remotely, operations upon the body.

Varieties.—The occurrence of insanity as a sequel of surgical operations has long been known. The more transitory forms of mental aberration, termed "traumatic" or "nervous" delirium, are recognized by all surgeons, although probably less frequently seen since the general adoption of aseptic methods in surgery. Within the past few years especial attention has been drawn to insanity following operations upon the female generative organs, and by some this occasional occurrence of mental disturbance has been held to be a contra-indication to the performance of such operations. It has been maintained that insanity follows removal of the uterine appendages with especial frequency, and that therefore the possibility of this unfortunate complication should demand particular attention before subjecting a patient to operation.

(1) Cases of serious mental derangement may occur after operations on patients without any previous personal or family histories of insanity; (2) mental disorders are no more likely to follow operations on the sexual organs than on any other part of the body; (3) such disorders occur just as frequently in men as in women; (4) operations are at times the determining cause of mental derangements where there was no previous tendency to the disease; (5) mental disturbances occurring a considerable time (months) after an operation are most probably independent of the surgical procedure; (6) the development of psychoses may follow in those cases in which the convalescence from the operation has been perfect; (7) the existence of a predisposition to psychoses should stay the surgeon's hand, except in such cases as are urgent and necessary; (8) mental derangements follow operative procedures with more frequency than is generally supposed. J. M. Baldy (Med. Age, Aug. 10, '92).

There is no proof that genital irritation in the male or female can cause nervous or mental disease, except in a predisposed person. The proof is not yet absolute that genital irritation can produce nervous and mental disease even in a predisposed person. L. C. Gray (Trans. Med. Soc. of State of N. Y., '93).

Gynæcological operations should be performed on insane patients only when the physical condition endangers life or renders it insupportable. Patients should be in a calm frame of mind before the operation and previous moral treatment instituted before it is undertaken. A. H.

McFarland (Annals of Gynæcology and Pædiatry, Oct., '93).

In all cases where the menstrual epoch acts as the exciting cause of insanity, the ovaries should be removed, even if there is no evidence of local disease. Eliot Gorton (Med. Rec., Aug. 25, '94).

Out of 300 castrations, in 200 cases operation had a beneficial effect; in 100 it was doubtful or untavorable. In 2 personal cases, both said to be cured, same results could have been reached without mutilation. Kraemer (Allgemeine Zeit. f. Psych., etc., B. 52, H. 1, '95).

The details of a number of cases of mental disturbance following surgical operations leave much to be desired on the score of fullness and accuracy. In perhaps the majority of instances authors consider it sufficient to state that "insanity" followed the operation. However, enough is known to warrant the conclusion that several forms of mental disturbance, agreeing in the main with certain prominent clinical varieties of insanity, are met with as such post-operative sequels: but there is no special and distinctive form of post-operative psychosis.

There can be little doubt that in persons with emotional instability the shock of a grave operation may produce transitory delirium, or even more persistent mental aberration. The frequency of the so-called "transitory mania" at the moment of the completion of the second stage of labor is evidence that intense pain, combined with high nervous tension, is capable of producing it. The delirium attending severe injuries—"traumatic delirium"—may also in most cases perhaps be ranged with the cases of mental aberration from shock. Those cases of post-operative delirium or psychosis following immediately after the operation may be classed in this category. That other factors may concur in the production of this form of psychosis—*e.g.*, anxiety, worry, and the like—is probable. Ahlfeld reported a case of violent mania following the introduction of a speculum, and Kiernan one consequent on the passage of a catheter in a man. In a small number of the reported cases no other essential factor than the shock and anxiety can be traced. From this form the patient usually recovers.

In insanity following surgical operation mental impressions may be produced in three ways: by anticipation, by actual operation, and by after-effects. C. T. Dent (Jour. of Mental Science, Apr., '89).

Literature of '96-'97-'98.

Three cases of mania after ovarian castration. One of these recovered within a month, while the other two committed suicide. Poirier (Rev. de Chir., April and May, '98).

Among several thousand operations, only five cases of insanity observed, and two of these were insane before the operation; a third was in a state of senile dotage; in the remaining two the mania followed upon important operations and was quite inexplicable. The exaggerated fear of operation, which one often meets with in women, is an important factor in the production of mental instability, and is a contra-indication, when very pronounced. Bouilly (Rev. de Chir., April and May, '98).

The nature of the operation does not have much influence on any subsequent mental disturbances which might develop. Hartmann (Rev. de Chir., April and May, '98).

A second class of post-operative insanity would appear to be due to the absorption of poisonous agents used before, during, or after the operation. It is now generally accepted that the acute mental disturbances, mostly hallucinatory in character, following operations upon the eye are due to the use of atropine and similar drugs. It is not improbable that

some of the post-febrile psychoses are attributable to a similar cause.

These cases of drug poisoning with pronounced symptoms of mental disturbance are probably not so very rare as sequelæ of grave surgical operations, particularly where extensive use is made of chemical antiseptics during the operation or in the after-treatment. The excessive use of opium, quinine, and other anodynes and antipyretics may with good reason be charged with some of the cases of post-operative insanity. The rare cases of mental disturbance following the administration of anæsthetics may properly be ranged under the same heading. One reason for this view is that in the large majority of these cases the symptoms are transitory and recovery promptly follows under appropriate treatment, the chief feature of which must be the withdrawal and elimination of the toxic agent.

Literature of '96-'97-'98.

If we exclude the pseudomania, or delirium resulting from alcoholism, from the anæsthetic, from iodoform, etc., it will be found that real post-operative mania is very rare; that the subjects of it, while chiefly met with in gynæcological practice, are the victims of sufficient mental predisposition to account for its occurrence. Potherot (Rev. de Chir., Apr. and May, '98).

No operation really "gives birth" to insanity. Like the anæsthetic, an operation may reveal certain latent tendencies, but does not create them. M. Regnier (Rev. de Chir., Apr. and May, '98).

A third class of cases of post-operative insanity I believe to be due to the absorption of septic materials from the wound or surface exposed during the operation. A study of reported cases shows that the insanity in most instances develops several days after the operation and is usually of the clinical variety termed "acute confusional insanity." The prominent symptoms are insomnia, restlessness, emotional instability; sometimes sudden, violent outbreaks, followed by incoherence, variable hallucinations, —especially of vision,—and sometimes delusions of grandeur or persecution. In most cases there are symptoms of fever, and usually marked implication of the physical powers. The pulse is rapid and weak, the temperature elevated, the tongue dry and red, and there is, usually, refusal of food. Exhaustion of mind and body rapidly intervenes, and the patient sinks into a state of muttering delirium, coupled with great bodily weakness.

Le Dentu has collected sixty-eight cases of post-operative insanity—thirty-eight following operations upon the female sexual organs and thirty developing subsequent to general operations. Generally, he says, the mental disturbance begins from the second to the fifth day, although in some cases not until the twentieth or even later. He discusses the possible causes of post-operative insanity, but does not offer a solution of the problem. Bantock, in referring to a case of "hysterical mania" following four or five days after an hysterectomy, says there was "considerable tumefaction of the mammæ to account for the disturbance."

Excluding the cases due to shock, nervous strain, exhaustion, and drug-intoxication, which generally appear within the first twenty-four hours, it is probable that the majority, if not all, of the cases of post-operative insanity coming on within the first week are septic in origin. Puerperal insanity is now generally regarded as essentially a septic psychosis, and in this large and well-studied class of mental disturbances we have the closest analogy to most cases of post-operative insanity. It is possible that

some of the acute cases following removal of the uterus or appendages are due to the sudden induction of the menopause, for so acute an observer as Krafft-Ebing considers the onset of the climacteric as a cause of acute delirium. Those cases of post-operative insanity coming on several weeks or months after removal of the uterus or appendages in women may be regarded as essentially cases of climacteric insanity (*q. v.*). The type is usually depressive. The cases that have been observed after extirpation of the testicles also usually present the melancholiac type.

Prognosis.—The prognosis of post-operative insanity is that of confusional insanity generally; *i.e.*, while the death-rate from exhaustion is large, amounting to 12 or 15 per cent., the recovery-rate of the remainder is also large. The cases that terminate in secondary dementia probably do not exceed 10 per cent.

The tardy cases of post-operative insanity so-called—those that come on in women from six weeks to three or four months after removal of the uterus or appendages—give a less favorable prognosis. The recovery-rate in these cases is not over 50 per cent.: about the same as that of undoubted climacteric insanity.

Literature of '96-'97-'98.

Reports of 109 cases in which ablation of the internal organs of generation was undertaken for the cure of hysteria and insanity, or other neuropathic conditions. Only 17 were affected beneficially. The remaining 92 were either uninfluenced or affected injuriously. Insanity afterward developed in 44 of these women, 20 of whom had suffered from hysteria before the operation, while 24 had not. Twenty-three others who were insane and hysterical prior to the operation were worse after it. Two not previously hysterical had become so. The remaining 23, who had been in part insane and in part hysterical, remained in the same state after operation. Angelucci and Pieraccini (Riv. Sper. di Freniatria, p. 290, '97).

Of 642 cases of hysterectomy and bilateral ovariotomy, only 4 personally observed in which the operation was followed by psychoses, and in all of them the patients were predisposed by inheritance or other factors. M. Segond (Rev. de Chir., Apr. and May, '98).

Mental disturbance, developing soon after operation, seldom proves serious, while, when it appears a few months later, the prognosis is usually unfavorable. Jacobs (La Policlinique, Apr., '96).

A systematic examination of all female insane patients, aided in nearly every case by anæsthesia, gave the startling result that 93 out of 100 insane women had pelvic disease. Eighty-nine were operated upon with the result of 37.5 per cent. mental recoveries; 22.5 per cent. improved; 35 per cent., unchanged; 5 per cent. of deaths. A. T. Hobbs (Jour. Mental Science, Jan., '98).

Sixty per cent. of the insane women personally examined had some abnormal condition of the pelvic organs, distinctly pathological and easily recognized. The primary question is relief of local disease: the insane woman has the same right to treatment as the sane, and if such treatment is likely to benefit the mental condition it is our duty to carry it out. A summary of 34 cases shows 11 complete recoveries (mental and physical), 9 improved, 11 unimproved in mental condition, and 3 deaths. Rohé (Jour. Mental Science, Jan., '98).

Treatment.—In the developed psychosis the treatment heretofore recommended for confusional insanity is indicated. Much may doubtless be done in the way of prophylaxis. Strict aseptic precautions during operation, removal of all sources of irritation, both physical and psychical, in persons of neuropathic constitution requiring operation, and careful attention to nutrition in those broken down in health from long-continued, painful, or exhausting disease, will tend to diminish the number of cases of insanity following surgical operations.

The use of chemical antiseptics and disinfectants in this connection also deserves attention.

Literature of '96-'97-'98.

There are many cases of women who have become insane through irritation of the ovaries who might derive benefit from surgery. The argument that the operation entails sterility on the women is of no weight, as such women are likely to bear unhealthy children and thus propagate their neuroses. Kroemer (Therap. Monats., Apr., '96).

Insolational Insanity.

Definition.—Insanity following insolation, or sun-stroke.

Symptoms.—After recovery from an attack of sun-stroke many persons suffer from certain indefinable changes in their character. They are more irritable, easily exhausted, especially in hot weather, and are liable to vertigo and other neurotic troubles. In a small percentage of cases insanity follows. This was already noted by Benjamin Rush, who reports two cases of madness caused by insolation.

The form in which insolational insanity occurs may be maniacal or depressive. In the former there may be sexual excitement with delusions of grandeur and untidy habits. The depressive form is usually attended by suicidal tendencies, delusion of persecution, anxiety, and hallucinations of sight and hearing. In some cases defective memory is the most notable psychical symptom. This may be accompanied by motor disturbances simulating general paresis.

Most writers who discuss insolational insanity class it with the traumatic insanities, assuming the evidences of meningeal inflammation, sometimes found, to be the causes of the mental disturbance. It seems to the writer, however, that the condition of the blood and vessels found post-mortem in cases dying of sun-stroke indicate such a profound change as can only be attributed to the action of a toxin. So it has seemed preferable to group the insolational psychoses with those due to toxæmia.

Prognosis.—Complete restoration of mental function is rare. A modified recovery, a partial dementia, is not infrequent.

Treatment.—This is purely symptomatic. Persons who have once suffered sun-stroke should avoid exposure during hot weather.

GROUP VII. PSYCHOSES DUE TO DEVELOPMENTAL CHANGES IN THE BRAIN. (See also INFANTILE MYXŒDEMA.)

Pubescent Insanity.

Definition.—Insanity occurring during the pubescent period of life.

By the "pubescent period" is not meant the arrival of the subject at the period of puberty, but the completion of the period during which the reproductive function is fully developed. This would include that period commonly called adolescence. The completion of this period in the female sex has been established by Matthews Duncan at about the age of twenty-five years. Clouston assumes this to be correct for both sexes.

There is a variety of periodical insanity beginning with puberty, coincident with disturbances of menstruation and ending when that function is regulated. It is to be differentiated from the usual forms of periodical menstrual insanity, and may be termed menstrual developmental insanity. Friedmann (Schmidt's Jahrbücher, Apr., '94).

Symptoms and Course.—By some authors a form of mental disturbance termed *hebephrenia* is described as the characteristic form of pubescent insanity. Hebephrenia is, however, in the majority of cases simply another name for the first

stage of paranoia. It includes the cases of so-called "moral insanity," which is usually merely a stage in the development of paranoia (*q. v.*). Clouston, who has made a philosophical study of this period of life, both in its normal and its pathological relations, describes pubescent insanity as follows:—

"The insanity of puberty in both sexes is characterized especially by motor restlessness. Such patients never sit down by night or day and never cease moving. There is noisy and violent action, sometimes irregular movements, or, in the few melancholic forms and melancholic stages of the maniacal cases, cataleptic rigidity. The mental symptoms consist most frequently in a kind of incoherent delirium rather than any fixed delusional state. In boys the beginning of an attack is frequently ushered in by a disturbance in the emotional condition—dislike to parents or brothers or sisters expressed in a violent, open way; there is irrational dislike to and avoidance of the opposite sex. The manner of a grown-up man is assumed, and an offensive 'forwardness' of air and demeanor. This soon passes into maniacal delirium, which, however, is not apt to last long. It alternates with periods of sanity and even with short periods of depression."

According to my observation, this is a true picture of the insanity of the pubescent period. The patients often recover in a short time after the beginning of the attack, but relapses are frequent. In girls, exacerbations are likely to occur in connection with the menstrual periods.

In those cases which do not recover, a mild form of dementia, resembling imbecility, follows. Maniacal states are, on the whole, more frequent than those of depression. When the latter are present they often have a religious tinge.

Masturbation, which most authors regard as an important concomitant, has probably little importance as a symptom.

Literature of '96-'97-'98.

Adolescent insanity is a pure psychosis, dependent upon hereditary factors and acquired conditions which especially inhibit the higher psychical centres and later the sensory motor functions of the cortex; the vasomotor and trophic centres are involved in it; the sympathetic, nervous function is disturbed, from which it is apt to end eventually, in the female, in suppressed menstruation, or even excitation, producing nymphomania; masturbation is a complication which, in the male, is apt to cause reflexes; there is no period in life more important than adolescence. F. P. Norbury (Nashville Jour. of Med. and Surg., Nov., '97).

Prognosis.—Authors usually give a very unfavorable prognosis in pubescent insanity. Excluding those cases, however, in which, from their symptomatology, belong to paranoia, I regard the prognosis as favorable. Under appropriate management pubescent insanity is a hopeful form of mental disturbance. Clouston reports that about one-half of his cases recovered.

Treatment.—The treatment of pubescent insanity should be tonic and reconstructive. If the patient appears to be too active in movement, he should be put to bed and carefully fed. Weighings should be made weekly to determine the bodily gain or loss. So long as the patient gains, he is doing well; if he loses weight, it is the duty of the physician to ascertain the cause.

The tendency to sexual excitement and to masturbation should be counteracted in a moral way. The administration of anaphrodisiacs is generally followed by more harm than benefit. Mechanical restraint of the insane for any purpose is bad practice. It is better to allow a pa-

tient to masturbate than to put him in a straight-jacket, or confine his hands in a "muff."

Climacteric Insanity.

Definition.—Insanity occurring during the period of sexual involution in women.

Among the more serious accompaniments of the menopause is mental disorder. Statistics show that insanity in women is especially frequent between the ages of forty and fifty years. As this is also the ordinary period of cessation of the menses, the conclusion seems reasonable that some relation exists between the two conditions, although it must not be assumed that mental disturbances at this period are necessary consequences of changes in the functional activity of the sexual organs.

Symptoms.—Any of the clinical varieties of mental disorder may be present during the climacteric; but melancholia is most frequent. In 22 cases studied by Goodall and Craig, melancholia was present in 66 per cent. In 21 cases under my observation exactly the same proportion were of depressive forms at the time they came under notice. Bevan Lewis states that, at the early evolution of climacteric insanity, painful mental states invariably prevail, and in the large majority of cases mental depression exists throughout the attack.

Hallucinations of hearing and of smell are frequent. Religious delusions color most cases. The class of cases termed by Savage "unpardonable sinners" are especially frequent among women who become insane during the climacteric. Bevan Lewis refers to these cases in the following terms: "Delusional states were recognized in 73 per cent., and out of a total of sixty-one deluded cases, sixteen were victims to the terrible delusion that the soul was eternally lost, and that the subject was to be consigned to the flames of hell. It is strange to witness the prevalence of this religious despondency at a period when, as we are aware, the generative organs are undergoing an important cyclical transformation, and to contrast it with the converse states of religious exaltation so frequently associated with the sexual transformation and excitation of adolescence, of hysterical and epileptic forms of insanity."

The fear of death, immediately impending or more or less remote, is often present. Frequently the memory and judgment are but little impaired, but the patients complain loudly of confusion of thought, fear they will become insane, will never recover, etc.

Delusions and hallucinations referable to the sexual sphere are common. Most cases of pseudocyesis occur during the climacteric. Fear of grave disease of the pelvic organs is often present. The subjective sensations of itching and burning in the external organs and the presence of leucorrhœa are probably the causes of this morbid fear. Actual disease of the sexual organs is, however, often present, and all cases should be thoroughly examined to determine this point. The great frequency of uterine cancer at this period of life must not be overlooked.

Delusions referred to the digestive organs are also present, although not characteristic. One case insisted that her internal organs were all decayed, and that therefore it was useless to give her food or medicine. If she had a stomach, she might possibly recover, but as this organ had been entirely destroyed there was no possibility of ever getting well. Another case insisted that her entrails had been taken out and thrown to the chickens. On her admission to hospital she refused food, but after several days' forcible feeding she began to eat and im-

proved rapidly in her physical condition. Her delusions gradually disappeared and she was discharged recovered after two months' treatment.

Delusions of grandeur are sometimes present in the maniacal and paranoiac cases.

Suicidal tendencies are frequent, although usually not so persistent as in melancholia generally. In one case, however, the patient set fire to her clothing "to escape from the devil," and was so severely burned as to result in death. Lewis refers to a case in which an attempt at self-destruction was made to escape a similar alleged danger. The apprehension of death by fire is frequent.

In some cases the depression and mental anxiety lead to the use of alcoholic stimulants, resulting often in confirmed intemperance.

While there is no specific form of mental disorder that can be properly termed "climacteric insanity," there can be no doubt that the menopause must be considered as one of the exciting causes of mental disease.

> Table of 100 cases showing truth of Morel's statement that, although the brain is always the seat of insanity, it is not always the seat of its cause. In 17 cases distinct post-climacteric atrophy; 9, enlarged uterine cavities; 12, enlarged cervices; 43, erosions of varying degrees of severity; 7, lacerated cervices; 17, retroversion; 3, anteversion; 7, latero-version, etc. Clara Barrus (Amer. Jour. of Insanity, Apr., '95).

Some writers devote much attention to the consideration of a climacteric insanity in the male sex, but there is no period in the life of man that corresponds with the menopause in women. The parallel that has been drawn between the period of involution of the sexual power in man and the climacteric period in women is, as Bevan Lewis says, "more fanciful than strictly correct."

Prognosis.—The prognosis of the insanities of the menopause is, according to authors, rather favorable. In my cases, including even those who had already passed into dementia when they came under observation, the recovery-rate was 43 per cent. Goodall and Craig had 38 per cent. of recoveries; Sutherland a fraction over 40 per cent.; Lewis 48 per cent.; Merson nearly 50 per cent; Skae 53.5 per cent., and Clouston 57 per cent.

Death is rare as an immediate consequence of the psychical derangement. Suicide and marasmus in those cases refusing food form the largest contingent of deaths in the acute condition. Among the chronic cases, tuberculosis claims the largest share in the death-rate.

Treatment.—The treatment of the mental disturbances of the menopause often tests severely the patience as well as the therapeutic resources of the practitioner. Refusal of food often depends upon delusions, but at times disorders of the *primæ viæ* are responsible. In the latter case stomach-washings, laxatives, and intestinal tonics such as nux vomica and physostigma are indicated. Where the reluctance to take food or its absolute refusal depends upon delusions that the food is poisoned or that the viscera are decayed, forcible feeding must generally be resorted to. In cases of aggravated gastric catarrh the subcutaneous infusion of a nutritive saline solution heretofore recommended will often be beneficial. After a few days' rest the stomach will take up its functions with renewed vigor.

The præcordial anxiety and palpitation of the heart, if troublesome, will generally yield to moderate doses of Hoffman's anodyne. For insomnia, paraldehyde is probably the least harmful hypnotic that can be used, although, where its odor and taste are objection-

able and there is no cardiac weakness, trional may be substituted.

The physical depression needs good food, fresh air, and tonic medication. In states of great weakness absolute confinement to the bed is necessary to prevent exhaustion.

Symptoms referable to the sexual organs are not always evidence of delusion, and should not be so declared until a careful physical examination has shown the absence of local disease.

Mental depression is best combated by cheerful surroundings, out-door life, and medicinally by opium. This drug should be given systematically, as recommended in melancholia. Cannabis Indica and belladonna are also at times useful. Cocaine has been recommended, but is dangerous on account of the tendency to establish a habit.

The good effects of thyroid extract reported, especially in melancholia, encourages to further trial with it.

The depressive hypnotics and sedatives—such as chloral, bromides, sulphonal, antipyrine, etc.—should generally be avoided in depressive mental states.

George H. Rohe.

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INSECT-BITES AND STINGS. See Wounds, Poisoned.

INSOLATION.

Synonyms.—Sun-stroke; heat-stroke; thermic fever.

Definition.—The terms "insolation," "sun-stroke," "heat-stroke," and "thermic fever" are applied to a series of symptoms occurring as the result of exposure to undue heat of the whole or parts of the system, while the latter is in a condition of physical debility, and resulting from intoxication by products of metabolism.

Symptoms.—The symptoms vary in intensity and nature, and three forms of insolation are recognized: heat-prostration, heat-apoplexy, and thermic fever.

Heat-prostration.—This form is frequently observed in cities during summer-heat, especially in persons in whom the powers of resistance have been weakened by alcoholism, ill health, and overwork. It is also the variety of insolation usually observed in soldiers, and is especially marked in men unused to marching or who are laboring under a malarial toxæmia. These two associated varieties as described by de Santi illustrate thoroughly the series of phenomena most frequently met with in active practice.

In the form characterized by individual weakness, the man who has so far marched well becomes silent, unbuttons his coat, and, if asked, complains of violent headache and oppression; but he continues his march up to the moment when he becomes pale and falls, with convulsive movements, as if in an attack of epilepsy. The teeth are firmly closed, the insensibility is absolute, the respiration difficult, the pulse small and irregular, and he often urinates involuntarily. A waxy pallor of the face appears also.

The patient moans, he streams with sweat, he drags in the rear, and if he continues his march he becomes still paler, while his lips become cyanosed; the jugular and temporal veins swell; the eyes become injected; the respirations shallow and quick, until the sufferer falls gently to the ground. He generally does not entirely lose consciousness, and, when he is laid down and relieved of everything which interferes with respiration, breathes deeply and quickly becomes himself again. Sometimes, however, on coming around, various nervous symptoms, usually not important, supervene.

The malarial form generally occurs in old soldiers who have long struggled with paludism. The man marches badly on starting, but becomes more animated as he goes along. His face is red, he does not seem to feel the fatigue, but is thirsty; suddenly, as if struck down by a club, he falls face downward in a state of absolute coma. Here, generally the face is turgid, but sometimes it is pale. This state may last for hours,—twenty-four or thirty-six,—and may terminate in death without recovery of consciousness.

Series of 31 cases: in 19 the heat predisposing to the attack was solar, in 11 it was artificial, while in 2 both factors were at work. The highest temperature attained was 112° F., more of the cases having temperatures, upon reception, between 110° and 111° F. than between any other two degrees. Twenty of the cases were unconscious, 8 were conscious, and 3 were partially conscious, while 4 were wildly delirious. Consciousness was maintained in every case where the temperature was below 108° F., except in one, where the temperature was 102.4° F. The pupils in 24 cases were extremely contracted, in 5 they were natural, in 1 they were sluggish, while in 1 only they were dilated. Where the pupils were contracted there was also present unconsciousness, except in 3 cases, and in these the temperature was 106° or over. Convulsions occurred in but 6 cases. The pulse varied much in different cases, being invariably absent at the wrist, where the temperature reached 108° F. Respiration in almost all cases was accelerated. Color of the face varied from flushed in the lighter cases, to livid and mottled in the cases with marked alteration in respiration and circulation. Involuntary evacuation of liquid, offensive stools was present in many of the cases, with the typical mousy, repulsive odor characteristic of these discharges. The longest time required to reduce temperature to within safe limits was within one hour, the average time being from ten to fifteen minutes. The prognosis could be made easily from the facility with which the temperature was reduced. The mortality in the whole series was 12 out of 31. The manner of death was, as a rule, by almost simultaneous cardiac and respiratory failure. F. A. Packard (Amer. Jour. Med. Sci., June, '88).

The temperature, at first subnormal, generally rises, especially in mild cases, to below 102° or 103° F. Recovery usually takes place in a couple of days under proper treatment. Mild cases may recover in a few hours.

The sequelæ most frequently observed in cases of heat-exhaustion are undue sensitiveness to even moderate temperatures; acceleration of the pulse and respiration; disorders of digestion; headache and vertigo; tenderness of the spine. Chromatopsia; irritability of disposition, particularly recurring with the onset of warm weather. Epilepsy and disorders of locomotion and sensation have also been observed. Impairment of memory and of the general aptitude are often observed.

The reflexes were, as a rule, exaggerated in a series of cases observed among soldiers. In 4 cases, epilepsy appeared after the insolation; in 2, partial hemiplegia: in 9, cutaneous anæsthesia; in 3, hyperæsthesia. The mental faculties were impaired. In the majority, memory was enfeebled. One case presented marked muscular tremors; in 27, there was deafness. Twenty-six presented impairment of vision. Sighing respiration was a not infrequent manifestation. In 14 cases the heart was irritable; in each of 15 a cardiac murmur was heard. In many of the cases the murmur was dependent upon the anæmia; in some it was organic. In some cases the heart was irregular or intermittent. Barlow (Cincinnati Lancet-Clinic, June 6, '91).

Case of a laborer, 31 years old, who, while at work, in midsummer, lost consciousness. For some five weeks he was delirious. During convalescence there was difficulty of speech and im-

paired motility and sensibility in the extremities. The man could not whistle; there was slight drooping of the lower lip on the left side; there was wasting of the muscles of the shoulder, and fibrillar tremor of these and of the biceps and triceps; if the arms were grasped below the elbow a coarse, purring thrill was felt; the muscles of the buttocks, of the thighs, and of the calves also presented fibrillar tremor; there was slight tremor of the lips and marked tremor of the tongue; there was persistent, dull, aching pain in the dorsal and lumbar regions; the knee-jerks were, perhaps, slightly subnormal; the muscles presented slight quantitative electric changes; the sphincters were competent; the hands and feet were cold and livid. Two applications of the white-hot cautery to the back were followed by a disappearance of the pain and by decided improvement in the symptoms. Dercum (Univ. Med. Mag., June, '91).

Literature of '96-'97-'98.

Case of insolation accompanied by hemiplegia in a boy, aged four years. Arthur F. Messiter (Lancet, June 26, '97).

Heat-apoplexy.—This form is much less frequently observed. It resembles to a great degree the variety of heat-exhaustion occurring in people suffering from malarial poisoning. Dizziness, intense local headache, the appearance of muscæ volitantes, marked throbbing at the temples, dryness of the skin, and dyspnœa are the most usual premonitory symptoms. Suddenly the sufferer falls, convulsions occur, followed, occasionally, by all the symptoms of cerebral hæmorrhage, barring the hemiplegia, but ending with cardiac failure.

In the majority of cases, however, this stage is not soon reached. Besides the first symptoms outlined, there is marked flushing of the face, which may extend to cyanosis; the breathing is stertorous; there is marked delirium; nausea and vomiting or, rather, retching, and the tongue is coated. In these cases the temperature may also be subnormal at first, but it usually rises until it sometimes reaches 115°, 116°, and even higher.

In moderate cases the temperature gradually falls and in three or four days the patient is able to go about. He is, however, very apt to suffer from either or many of the sequelæ already enumerated.

Thermic Fever or Hyperpyrexia.—This is an aggravated form of the preceding and is not infrequently witnessed. It is characterized by excessively high temperature—sometimes 115°, 116°, and even 117.8° F., as in the case observed by Lambert. This means death, preceded by intense dyspnœa, asphyxia, and coma in the majority of cases, but by no means in all—under proper treatment.

In a considerable proportion of cases there are preliminary symptoms which, if accepted as warning, might prevent the development of the more dangerous features—nausea, cramps, progressively increasing weakness, vertigo, blurred vision, intense headache, and cessation of the perspiration. If these symptoms do not cause the patient to realize that he is in danger, and to repair to a cooler spot—the active symptoms of thermic fever appear. The skin, from dry, becomes flushed, red, and burning; it may finally assume a bluish tinge, while the mucous membranes become markedly cyanotic.

A thermometer left *in situ* would indicate that the temperature is steadily rising, and though perhaps subnormal at first, reaching down as low as 95°, it may reach the temperature already mentioned. The pulse follows the temperature, and is at first full, bounding, and non-compressible, then becomes rapid;

the number of respirations also follows suit, varying from 20 to 60 per minute. The eyes are watery and fixed, and the pupil is contracted.

Clonic spasms, alternating with rigidity, are often observed. There is moaning, delirium, and jactitation, unconsciousness usually accompanying these symptoms. The urine and fæces are passed involuntarily,—though the secretions are sometimes totally suppressed,—and exacerbations of dyspnœa, noticeable from the start, gradually assume the state of asphyxia, followed by death.

A fatal issue does not always follow, however; and the use of appropriate means, especially the cold bath, often saves patients whose temperature has reached extraordinary limits.

> Case of "electric sun-stroke" observed. The patient had been engaged some twenty minutes in adjusting the screw which separates the carbon points of an arc-lamp, his face being held some 15 to 20 inches or more from the arc, and had neither covered his eyes with smoked glasses nor taken any precaution against radiation. The current was 12 to 14 ampères, with a potential of 44 volts, and the lamp had an illuminating power of about 200 Carcel burners. Two hours and a half later the man supped with good appetite, and three hours after this went to bed and slept soundly, as usual. About midnight he was awakened by feelings of insupportable pain and burning in the face, and especially the eyes. He was unable to see, covered his eyes, and complained of great scorching, which was aggravated by the least access of light. The lids and conjunctivæ were red and swelled, with muco-purulent discharge. With pain he distinguished between light and darkness, but could not distinguish objects. The entire face was reddened, especially around the eyes. Recovery took place under the following treatment: Belladonna ointment around the eyes and to the lids: cold compresses to the eyes: occlusion: hot foot-baths: saline washes, with, later, the addition of Van Swieten's solution. Prat (Archives de Méd. Navale, Dec., '88).

Diagnosis.—The special conditions attending these cases and the character of the symptoms render diagnosis easy in almost all cases.

Acute Alcoholism. — In this the odor of alcohol and the previous history of the case render diagnosis easy.

Cerebral Hæmorrhage. — This is probably the disorder for which insolation is differentiated with some difficulty. The absence of hemiplegia is considered as reliable sign by Flint.

> Three types of sun-stroke specified. The cerebro-spinal, characterized by symptoms of intense congestion—by injection of the face and conjunctiva, by stertor, coma, and convulsions: the syncopal, or cardiac, type, made manifest by pallor of face and profuse perspiration, death taking place by arrest of the heart; and the pulmonary form, in which, in addition to some of the symptoms pertaining to the other two there are anxiety, dyspnœa, and asphyxia. Sun-stroke usually arises under conditions of mental or physical overactivity in conjunction with undue exposure to heat and a suppression of the secretions, the disease being dependent upon retention, in the system, of toxic products of retrograde metamorphosis. Martin (La Sem. Méd., Sept. 16, '91).

Etiology.—Excessive heat in any form is usually considered as the main factor in the production of insolation. It may not only occur in the street, but also in a boiler-room, a laundry, etc., showing that heat is the predominant factor. Heat-exhaustion may be brought about by excessive exertion under unfavorable conditions, while sun-stroke is due to excessive heat and occurs during the hottest season of the year. The latter exhibits remarkable endemic characters, in that it is extremely prevalent in one locality, in another is totally absent, though the region may be quite adjacent

and under precisely similar climatic influences: again, its ravages in different years vary immensely and quite irrespective of heat. (Sambon.)

Exercise strongly favors production of heat-stroke. Excessive temperature acts directly on the nervous system and not by inducing autointoxication or coagulation of muscle-fibre. Laveran (Bull. de l'Acad. de Méd. de Paris, Nov. 27, '94).

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Insolation is due, not to discrete local lesions, but rather to some direct effect on the brain as a whole. Jackson (Boston Med. and Surg. Jour., Feb. 4, '97).

According to Phillips, meteorological conditions predispose to sun-stroke, and these involve high temperature, relative humidity, wind, and climatological characteristics, as well as the direct rays of the sun. The attack is no more dependent on high temperature and direct insolation, he thinks, than it is on low relative humidity.

The reduction of physical resistance to the action of heat upon the nerve-centers and a secondary disturbance of metabolism probably at the bottom of these cases. Thus fatigue,—mental and physical,—insufficient food, unsanitary surroundings, and worriment are all noted as predisposing factors. Alcoholism is particularly active in this respect.

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The colonial governments of Australia having asked the medical board to issue appropriate instructions as to prophylaxis from sun-stroke, the fact was elicited that, of all predisposing causes, undue indulgence in intoxicating liquor is the most common and the most dangerous. Further, that during the attack it is dangerous to employ intoxicants as a remedy. Editorial (Brit. Med. Jour., June 20, '96).

Clinical and pathological study of 805 cases in which the main factor was shown to be an autointoxication, with heat as a contributing cause. Lambert and Van Gieson (Medical Record, July 4, '97).

Of 465 cases whose histories were known out of a total of 841 cases, 30 per cent. were alcoholic, 50 per cent. moderate drinkers, and 20 per cent. teetotalers; while of 70 deaths, 60 per cent. occurred in alcoholic patients, 30 per cent. in moderate drinkers, and only 10 per cent. in teetotalers. Phillips (Inter. Med. Mag., Aug., '97).

Males are more frequently affected than females, and children—though less frequently attacked—are not free from the disorder, especially when the head is exposed to sun-rays.

Three cases of thermic fever in infants, each about one year old. The cases developed during the heated term, amid the most unfavorable surroundings. Each presented vomiting, diarrhœa, high temperature, and symptoms of profound depression. The cold wet-pack was used in treatment, with most successful results. Illoway (Med. News, Aug. 8, '92).

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Convulsions and even death caused by allowing children to walk about in the water at the sea-shore with their clothes tucked up, their feet chilled, and their heads exposed to the blazing sun. Whitfield (Brit. Med. Jour., Aug. 8, '96).

The majority of cases occur in the afternoon, though cases are not infrequently observed at night, especially in poorly-ventilated quarters. In stoke-holes, boiler-rooms, sugar-refineries, etc., where the heat is intense, heat-strokes may occur at any time.

Pathology.—After a study of eight hundred and five cases of insolation, Lambert and Van Gieson found that heat alone is not sufficient to explain all the clinical and pathological observations. The prodromal symptoms of sun-stroke are those of acute functional dis-

turbance, while the later symptoms, much more serious, point to grave changes in the blood and in all the nerve-centres, especially those of the latter which control the thermic mechanism of the body.

Van Gieson examined the brain and cord in several of Lambert's fatal cases, and found universal exhibition of acute degeneration of the neurons of the whole neural axis. In the cerebral cortex and cerebellum the cells showed the same degenerated changes; the cells of the spinal cord were not so extensively involved. The toxic agency of the symptoms of insolation seem to be shown by the changes found in the ganglion-cells. They were, in every way, similar to those produced by a number of other poisons, such as by alcohol, lead, etc., and by bacterial products.

The experiments by Vallin would tend to show that coagulation of the albuminoid bodies occurs. The toxæmia would thus occur as a result of arrested metabolism. The blood is dark, though fluid, and the corpuscles are crenated. In the hyperpyrexial form leucocytosis and degeneration of the red corpuscles may also be noted. Extravasations in the peripheral tissues are often found, and the body undergoes rapid putrefaction.

According to de Santi, insolation is in all cases characterized, from a pathological point of view, by arrest of the heart, but dependent on different causes. These may be classified as arising from intoxication by the products of muscular effort; from asphyxia; from a malarial infection called into activity by fatigue or heat. In the first form, that of intoxication by the products of muscular exertion, the victims are chiefly among soldiers unaccustomed to the fatigue of a march. The attacks occur when the temperature is high and the air is calm and humid; so that the cutaneous evaporation is small.

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The following is a description of the micro-organism found in the blood of patients suffering from heat-apoplexy and regarded as the specific cause of that disease. It is linear, incurved, and slightly constricted in the middle. Viewed in the blood, it is from 2 to 2.5 microns long, and 0.5 micron thick; in cultures it is somewhat larger. It presents filaments, is slightly motile, but possesses no cilia, stains easily with aniline colors, but not by Gram's method. There are free spores in the cultures as well as in the rods. It is aërobic, does not cause fermentation in sugars, and does not give rise to indol. It grows between 30° and 37° C., but is instantly killed by a moist heat of 70° to 75° C. Cagicol and Lapierre (Montreal Clinique, Apr., '98).

Treatment.—Hydrotherapy and skilled and careful nursing seem to be the chief factor, in treatment of insolation; frequent recording of the temperature enabling the baths to be given at the earliest and, therefore, most effectual time; the use of the ice tub-bath, with constant and general friction of the entire surface, thus reducing the temperature in the shortest possible time, and being stimulating rather than depressing; the use of the same bath for all severe secondary elevations of temperature, and for the minor elevations sponge-baths of ice-water or of water at from 70° to 80° F., depending upon the individual case; and the repetition of these baths whenever the temperature is high enough to make them seem advisable. All other means have seemed entirely inadequate to N. R. Norton.

At St. Vincent's Hospital, New York City, the following method of treatment of insolation has given good results. It

is given here as detailed by G. F. Chandler, because it seems most in accord with modern views as to the pathogenesis of insolation. The ambulances are well supplied with ice, which is kept about the patient's head from the moment he is picked up until he enters the hospital.

Upon admission the patient is immediately stripped. His temperature, per rectum, is taken as he is being placed upon a raised stretcher or table.

The body of the patient is covered with a sheet, upon which are placed small pieces of ice. Large quantities are laid closely about the head. Ice-water from dippers, at a distance of from five to ten feet, are dashed with force upon the patient. This is continued about thirty or forty minutes.

The most efficacious stimulant, and one which has served to arouse when everything else has failed, was the pouring, from an elevation, of a fine stream of ice-water upon the forehead. As this treatment is very radical, it is continued for only one or two minutes at a time. In severe cases it is repeated several times, unless consciousness returns.

While this is going on, each patient, with very few exceptions, is given hypodermically 40 minims of the tincture of digitalis at one dose. Exception is in the case of the plethoric patients with great tension in the arteries. Upon such patients venesection is practiced, and later tincture of digitalis is given in smaller doses.

The temperature is carefully watched, and when, after hyperpyrexia it reaches 104° F., the patient is laid in a bed, covered with blankets, and hot bottles are placed about him.

When the temperature is reduced to 99° or 100° F. by bath, as is usually practiced, clinical history shows that it nearly always becomes subnormal—even falling at times as low as 91° F.—and leaves the patient in collapse. When the temperature is only reduced to 104° F. it will, in most cases, continue downward of its own accord.

Strychnine is never given. It has proved upon trial to cause convulsions or make them more violent. Convulsions are treated by chloroform.

When the secondary rise of temperature occurs, a sheet, wrung from ice-water, is spread over the patient, and kept wet until the temperature became normal. In some of the cases, where the secondary rise is very rapid, the entire ice-and-water treatment is repeated several times, or until the temperature remains normal. An ice-cap is kept upon the head from the time the temperature becomes normal until the patient is dismissed. This has been found of the utmost value.

In cases of prolonged unconsciousness patients are nourished and stimulated by means of the stomach-tube.

In extreme cases hypodermics of whisky are used.

As death seems the result of respiratory paralysis, artificial respiration is kept up for long periods of time—often half an hour or more. Surprising results are sometimes obtained.

The after-treatment consists of light diet, stimulants, fresh air, the ice-cap, and sudorifics, such as ammonia—preferably the spirit of Mindererus—in large doses.

> Preference expressed for the wet pack over the cold bath in the treatment of heat-stroke. The wet pack does not produce so rapid a depression of the temperature; but, on the other hand, it is not followed by a secondary elevation. A large muslin sheet is wrung out of cold water; the patient wrapped in the sheet, placed in bed, and covered with a blanket. As soon as the sheet becomes warm it is removed and replaced by an-

other that had meanwhile been cooling in the water. This procedure is continued until the temperature reaches the normal. Illoway (Med. News, Aug. 8, '91).

The only method by which excessive fever can be controlled is the cold bath in the most active form; same active friction of the skin necessary as is employed in the Brand treatment, bringing hot blood from centre of the body to the periphery. Still colder application to the head to prevent fatal cerebral congestion. Equally important is venesection, which should be copious, particularly indicated in cases in which there is much cyanosis or convulsions. Secondary and tertiary rises of temperature frequently occur, suddenly shoot up, remaining high persistently. In severe headache during convalescence, venesection of greatest value; drugs tending to produce cerebral congestion, such as quinine, to be avoided. (Ther. Gaz., '95.)

During convalescence, if pulse bounding, veratrum viride and bromide of sodium useful; if pulse weak, ergot. Counter-irritation to the nape of the neck where evidences of meningeal irritability exist. If surface of the body is very cold, high injections of cold water into the colon, reducing heat and driving congested excess of blood to the surface. If heat-exhaustion occurs in which there is an unusual fall in bodily temperature, hot injections or baths. E. C. M. Page (St. Louis Clinique, June, '95).

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Ice-baths and the ice-cap resorted to, but antipyrine employed to keep down temperature. Smyth (Brit. Med. Jour., Jan. 9, '97).

The ice-pack and ice-cap recommended, and ice-water dashed with force from dippers at distances of from eight to ten feet for thirty or forty minutes if necessary. The most efficacious stimulant, though it can be applied only one or two minutes at a time, is a fine stream of ice-water poured from an elevation upon the forehead. Finally, most patients are given subcutaneously 40 minims of digitalis at a dose, unless the sufferer is very plethoric, in which case venesection is practiced, and the foxglove given later on in smaller doses. O'Dwyer (N. Y. Med. Jour., June 5, '97).

Great relief is obtained in cases of heat-exhaustion from the application of cold over the spine. In sun-stroke the cold bath, rubbing with ice, blistering, shaving the head, and the use of antipyrine is advocated; although these measures cannot compare, in the writer's estimation, with the effects of heat applied over the last four cervical and first four dorsal sympathetic ganglia. The application of heat to this region and of cold to the head, and also the inhalation of oxygen, have been followed in his practice by the best results. Kinnear (Med. Rec., Aug. 21, '97).

In thermic fever in infants the ice-bath condemned. In the milder form sponging the body with hydrant-water and the administration of more water internally is all that is required. In the severe forms a bath, the temperature of which is not below 60° F., may be used; at the same time friction should be vigorously applied to keep the peripheral arterioles dilated. Stimulants may be given as required. In the hyperpyrexial forms it is well to make the skin intensely red, as by nitroglycerin, friction with towel or hand, or a mustard bath; then even sponging with hydrant-water will rapidly produce the desired result. Spraying cold water on the patient has been found to be the most effective treatment. The water should not be too cold. For convulsions and tonic spasms chloroform is important. Free perspiration should be induced as soon as possible. Diuretics act well by assisting the elimination of waste-products. Nux vomica should not be administered, as it may only be synergist to the toxin. Water should be given as soon as possible and freely administered until convalescence. John Zahorsky (Pediatrics, No. 4, '98).

In the Indian territorial service, when sun-stroke occurs in the open, the subject is at once removed to a cool and shady place, placed in a recumbent position, with the head slightly elevated, to which cold applications are made. The chest and shoulders are stripped and cold-douched. Then hypodermic injec-

tions of the following are made in different places about the shoulders:—

℞ Quin. sulph., gr. 5.
Acid. sulph. dilut., m. 5.
Aquæ, m. 50.
M. ft. liquor.

Should the heart's action be weak, the following is used, hypodermically:—

℞ Strychninæ sulph., gr. 1.
Aquæ, m. 200.
M. ft. liquor.
Sig.: Inject 5 minims (equal to $^1/_{40}$ grain) p. r. n. C. Fitz-Henry Campbell (Med. World, Aug., '98).

A watery solution of antipyrine (1 to 2) should be carried in the pocket for instant use when there is danger of encountering cases of sun-stroke, and as soon as the patient is seen 20 minims should be administered hypodermically. Lewis (Phila. Med. and Surg. Reporter, July, '98).

INTERMITTENT FEVER. See MALARIA.

INTERNAL EAR, DISORDERS OF.—The percipient apparatus of the ear is relatively rarely affected and furnishes but 2 to 10 per cent. of the cases in the statistical tables,—the larger figure embracing apparently every case which gives evidence of nerve-involvement, however secondary in fact and importance to tympanic trouble. It comprises the congenital defects as well as the central lesions, such as nerve-atrophy in tabes, word-deafness from cortical lesion, and many other rare cerebral affections; but the group which most concerns us in this practical review is made up largely of lesions of the labyrinth due to the specific affections, including syphilis.

Tuning-fork Tests.—The diagnosis of these affections is largely from negative evidence, much of it furnished by the tuning-fork tests of the function: and these had better be here considered.

Tuning-forks can be conveniently used, giving tones due to vibrations of from 50 to 2000 per second, and much can be learned by use of A = 213 v. s. or C = 520 v. s. alone; but it is not best to trust to any one tone. The lower forks must usually have clamps to dampen the overtones (such can be improvised by slipping bits of rubber-tubing over the ends), and in the absence of such will often give the notes one or two octaves higher coincidentally with the fundamental. For this reason and for its convenient duration of vibration I prefer the A = 213 v. s., of medium size, more often found in the shops. Such a fork, struck upon some rather soft surface by falling its own length, should generally be heard some 90 seconds through the air when held before the ear; while with its handle resting upon the mastoid or other portion of the skull or face it should be audible slightly less than half as long. It should be heard equally in each ear from points in the middle line of the head; and the sound-waves should escape from each canal, as can be heard through the auscultation-tube. Stopping the canal with the finger should increase the sound in the closed ear to a degree that extinguishes its perception in the other and makes the sound again audible by bone-conduction after it has been lost normally. Low tones are heard better relatively by bone; high tones by air; so high-pitched forks should have long handles if their use on the mastoid is to be free from possible fallacy. Low-toned forks should be lightly struck to test bone-conduction, lest their vibration on the head should be oppressively loud.

If we place the vibrating A-fork on one mastoid it should be heard for some 40 seconds, as stated, and for some 50 more when transferred to the front of the canal; and each other fork has its

fairly-definite proportion for a normal ear, equal on the two sides. But in deaf ears the finding will be different and discrepant perhaps on the two sides. Lesion of the conducting-apparatus will impede alike the entrance of sound-waves by air and their escape from the tympanum when awakened there through bone-conduction. Hearing by air-conduction will be subnormal, by bone-conduction it will be exaggerated; the proportion changing from 90:40 to perhaps 30:50, bone-conduction preponderating. This is Rinne's or Schwabach's test,—modified by Roosa very practically by merely noting whether it is "louder front? or back?" as almost any patient can rightly decide.

If the deafness be due to the percipient apparatus, the normal preponderance of air-conduction will continue, bone-conduction being relatively worse, or, perhaps, totally lost. The proportion may now be A. C. 40: B. C. 10. So, too, from the middle line of the head the hearing will be worse in the worse internal ear, whereas if the trouble be in the conducting apparatus the more obstructed ear will be the one hearing louder by bone-conduction. This is Weber's test.

Gardiner Brown modified Weber's test by resting the tuning-fork on the bridge of the nose and having the patient raise his finger just when he ceased to hear its vibration. As this should be exactly when the vibrations ceased to be felt by the fingers of the examiner, a rough, but practical, measure is gained (for each ear if unequal) of the increase or decrease of the bone-conduction, and the result is conveniently stated as + 3 seconds, — 4″, etc.

Cases will frequently be met where these tests give uncertain or contradictory results. Patients will give their preconceptions instead of observing the actual perceptions, unwilling to say that they hear by bone louder in the ear which they know to be worse or confusing palpable vibrations with their weakened auditory perceptions. A deaf-mute will often claim to hear the fork as well resting on the patella as when on the mastoid. Yet a little patience and variation of the tests will generally clear up contradictions. The high tones are later and in less degree lost in tympanic affections, unless thickening of the drumhead shut out some such sound tone as the impure of the watch-tick.

The catarrhally deaf usually hear relatively or even actually better in a noise, — "paracusis Willisii"; whereas those with nerve-deafness are made worse by it. Very high tones, such as given by the Koenig rods or the Galton whistle, may be inaudible to a diseased labyrinth or portions of the gamut may be lost, while all voice-tones, as well as much deeper notes, are normally heard. These limitations must be learned and borne in mind: then the tuning-fork tests will generally be found to lead to correct diagnosis: and the many instances of mixed affection will be noted as well as those which are totally differentiated.

> In affections of the Eustachian tube and in those of the external aural ductus, the sound of a vibrating diapason is always heard on the shut or impaired side stronger than on the crossed side. In cases of disease of the tympanic cavity without involvement of the acoustic nerve it is always heard from the direct side, though one side is more impaired than the other. In cases of diseases of the tympanic cavity with hyperæsthesia of the acoustic nerve, or in cases of this condition only, the sound is heard from the hyperæsthetic side, but stronger on the crossed side. In cases of disease of the internal ear (atony or atrophy of the acoustic nerve), with or without impairment of the tympanic cavity, the perception of the crossed sound is abolished, while sometimes the direct sound con-

tinues (although very weak). Masini (Bullettino delle Malattie della Gola e del Naso, July, '88).

Literature of '96-'97-'98.

Ability to hear the voice at a distance proportionately greater than the distance at which the sounds of a clock can be heard is a symptom of disease of the cochlea or of the acoustic nerve. Four principal types of cases may show a disproportionate relationship in the ability to hear these two classes of sound: 1. Aphonic voice and clock with strong tick heard at about the same distance,—a rare type appearing in slight affections of the sound-conducting apparatus. 2. The voice heard about three times farther than the clock,—a more frequent type, found in nerve affections of the sound-conducting apparatus. 3. The voice heard at a still greater distance,—fifty times farther than the clock, as in disease of the inner ear in young subjects. 4. The clock heard farther, sometimes ten times farther than the voice,—a rare type seen only in hysterical conditions and quite characteristic of this affection. Gradenigo (Annual, '96).

Diagnosticated in the manner outlined above there will be a small, but important, group in which there has been a small-cell infiltration of the labyrinth as the result of syphilis, acquired or inherited; of cerebro-spinal meningitis, or typhoid, or other fevers. The onset of the deafness may be sudden, usually without vertigo, or it may be stealthy and gradual. Acoustic hyperæsthesia may precede it, and the condition may be very unequal on the two sides. In children, who are its more frequent victims, it is generally only noted that they do not hear or that they are not talking as they should. Convulsions without defined or protracted illness may be reported as the starting-point, or trauma with loss of consciousness. The deafness following mumps may belong in this category, but generally seems rather an acoustic paralysis.

Autopsies in cases of cerebro-spinal fever where there had developed deafness *intra vitam*, which revealed destructive tissue-changes in the internal ear. The processes were suppuration and necrosis. The probable cause is a direct action of the morbid virus upon the capillaries of the periosteum,—and pre-eminently in the semicircular canals,—producing vascular stasis and thrombosis in this membrane, with consequent necrosis of the structures thereto attached. Steinbrugge (Archives of Otology, vol. xvii, p. 51, '88).

Two cases of total loss of hearing in both ears consequent upon mumps. One patient had suffered from purulent otitis; the other case presented normal membranæ tympani. In such cases the lesion is located within the labyrinth. Barr (Glasgow Med. Jour., June, '89).

As a result of scarlatina, three different conditions of the aural mucous membrane are noted: 1. Great swelling, with serous infiltrations of the connective-tissue stroma. In such conditions the exudate is purulent and tends to perforation of the drum-head. 2. Necrosis of swelled mucous membrane; so that, in many cases, the ossicles are denuded of periosteum. 3. Acute carious process upon the wall of the labyrinth and the ossicles. This condition soon leads to inflammation of the membranous labyrinth. L. Katz (Deutsche med.-Zeit., July 8, '90).

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Deafness, tinnitus, and vertigo may be caused by either congestion or anæmia of the labyrinth. The inhalation of a few drops of nitrite of amyl will temporarily relieve these symptoms if they be due to ischæmia, but will increase them if they be due to congestion. This differentiation of etiology will enable the physician to properly treat the disease. Lermoyez (Ann. des Mal. de l'Oreille, July, '96).

Apoplectiform affections of the labyrinth in two men employed in submerged caissons. When the Eustachian tube is permeable the ear endures the increased atmospheric pressure in submarine caissons; when it is not permeable, the in-

ward pressure of the membrana produces congestion of the drum-cavity and finally of the internal ear. F. Alt (Aust. Otol. Soc., June, '96; Ann. des Mal. de l'Oreille, Jan., '97).

Syphilis.

The stigmata of inherited syphilis are to be sought in the typical facies: with it exaggerated naso-labial lines, the high-vaulted palate, wide-spaced and pegged incisor teeth, only sometimes notched, the clouded corneæ or nodes upon the shin or other bones. The family-history, with miscarriages and early deaths or typical lesions in other members, may be our only evidence.

Literature of '96-'97-'98.

Absolute deafness cannot be merely tympanic; in such cases we can conceive of no obstruction which could totally prevent conduction to a sensitive labyrinth, and must assume impairment of this or the centres beyond. In some instances where the response to tests is uncertain or contradictory, the presence of Hutchinson teeth, interstitial keratitis, or other evidences of congenital syphilis may serve to warn us of the probability of deeper trouble, even if the abnormality of the drum-heads may seem to account for the deafness as tympanic.

In any case where the patient seems worse for inflation, it will be well to review the tests for suspected affection of the internal ear: and unless explanation can be found in an overdistended drum-head or unintentionally vigorous use of the air-douche, even negative findings must put us on our guard. B. A. Randall (Phila. Polyclinic, Feb. 8, '96).

Form of acute syphilitic affection of the ear, probably due to an effusion into the labyrinth in a previously normal ear, is characterized by sudden deafness, tinnitus, and vertigo, coming on in the late secondary or early tertiary stage of systematic syphilis. The difference between this form of sudden deafness, tinnitus, and vertigo, and that due to non-syphilitic causes is that the deafness is not so profound in the specific form. The syphilitic aural affection yields promptly to a few doses given hypodermically of pilocarpine ($^1/_6$ grain), whereas non-syphilitic labyrinth diseases are entirely unaffected by pilocarpine. E. A. Crockett (Boston Med. and Surg. Jour., Feb. 11, '97).

Treatment.—Whether syphilitic or not, the same treatment is indicated. Absorption of the infiltration by mercurials and iodides constitutes our main resort. In recent specific cases Politzer's vigorous use of pilocarpine has given excellent results in some cases: but the treatment cannot always be borne, is inconvenient with its sweatings, and can hardly equal for the ear or for the general condition the usual antisyphilitic medication. Long-standing cases offer little prospect of benefit, but they have been known to gain beyond all expectation: and the underlying disease may in itself demand treatment.

Subcutaneous injections of pilocarpine, beginning with 2 drops of a 2-per-cent. solution and increasing to 8 drops, are of great service in all recent affections of the labyrinth. From 10 to 15 injections ought to produce the result aimed at: if not, the remedy is to be abandoned. Politzer (Lancet, Jan. 2, '91).

Nitroglycerin exerts but little influence in disease of the labyrinth in hereditary syphilis (where the iodide of potassium yields better results). It is of the greatest utility in the removal of hæmorrhagic extravasation or recently-organized lymph, especially in acute processes in the labyrinth. Politzer (Weiner med. Blatter, No. 4, '88).

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In a case of anæmia of the labyrinth trinitrin in doses of $^1/_{100}$ grain three times daily permanently relieves the deafness, tinnitus, and vertigo. In cases of congestion of the labyrinth an alterative or absorbent treatment is indicated. Lermoyez (Ann. des. Mal. de l'Oreille, July, '96).

Pilocarpine gives the best results in syphilitic diseases of the internal ear.

Thomas J. Harris (Manhattan Eye and Ear Hosp. Rep., Jan., '97).

Labyrinthine Effusion (Meniere's Disease).

Another notable group includes the cases of labyrinthine effusion causing vertigo and deafness, generally associated with Ménière's name. "The Ménière complex of symptoms" is now generally spoken of, and some writers have not only differentiated tympanic vertigoes, but have inclined to deny the reality of "Ménière's disease." Yet, clear-cut cases of this affection do undoubtedly occur, and the influenza epidemics caused not a few of them. The seizure is usually apoplectiform, with intense vertigo, not infrequently severe nausea and marked deafness. Some cases note the dizziness only on rising, but others are almost as distressed by it while at absolute rest in bed. Whether the acoustic or the co-ordination areas of the labyrinth are the seat of the lesion, both functions are at first profoundly affected; but the mere serous effusions can probably absorb completely, leaving no loss of hearing. As the labyrinth vertigo is usually an *irritative* lesion, disappearing equally whether resolution or destruction be the result, it is possible that all of the profound affections are exudative or hæmorrhagic, but that we have no means of recognizing the destruction left in the semicircular canals, if the limited lesion is here. Some cases of typical labyrinthine apoplexy recover almost completely, but with a permanent gap at some part of the auditory scale.

In gouty cases a train of symptoms suddenly arises, resulting from serous effusion into the labyrinth, and giving most of the characteristics of Ménière's disease,—tinnitus and deafness, especially for tones of high pitch, being intense. The musical sense is lost. The attack disappears, but recurs with ever-shortening intervals of health, and produces progressive impairment of hearing. A point of differential diagnosis between this condition and a simple catarrhal process is that, in the latter, there exists an inequality in hearing between the two ears. In labyrinth effusion, the conducting apparatus being unaffected, the note will be heard as one clear sound. Alex. Ogston (Med. Press and Circular, June 11, '90).

In two cases the patients presented all the phases of Ménière's disease, while the parents and other members of the family suffered either from similar symptoms or from nervous manifestations. Simon (Johns Hopkins Hosp. Bull., Sept., '93).

Ménière's disease is relatively frequent in cases of ozæna, while middle-ear catarrh with nasal disease has occurred in many cases. Among constitutional dyscrasias syphilis is a frequent exciting cause of labyrinthine hæmorrhage, while many cases may be traced to Bright's disease, atheromatous arteries, exertion, trauma, mumps, etc. Thomas Barr (Brit. Med. Jour., Dec. 28, '95).

Literature of '96-'97-'98.

The deafness resulting from an intense extravasation within the labyrinth, such as occurs in Ménière's disease, never disappears and is usually bilateral. T. A. Kenefic (Med. Rec., July 25, '96).

Treatment. — Total rest, derivatives, and perhaps blood-letting should be first tried, followed by absorbent alteratives. Charcot's use of heroic doses of quinine should be a last resort, as a means to complete the destruction of tissues incapable of resolution.

In treatment of Ménière's disease reliance placed upon quinine, especially in the chronic forms, and combined, usually, with ergotine in equal dose, namely: from 9 to 15½ grains daily. In the apoplectic type of the disease quinine is superfluous, but iodide of potassium is of great use. Tsakyroglous (Monatshefte f. Ohrenh., Nov., '92).

Three cases of Ménière's disease cured by the administration daily of three powders containing each 46 grains of bromide of potassium, and three pills,—

valerianate of iron, 15½ grains; opium, 4 grains; extract and powder of cascara sagrada, q. s. ad pil. xij. The cure was permanent. Roméo Mongardi (Annales des Mal. de l'Oreille, etc., Dec., '92).

The effect of quinine, salicylic acid, and other drugs upon the labyrinth is often misunderstood. They certainly cause hyperæmia in physiological dose; but probably here, as elsewhere, in toxic doses produce profound ischæmia, such as is seen in the eye in quinine-blindness. Diseased ears are apt to be especially susceptible to the tinnitus and other discomforts of these drugs; but it is an open question whether they are more prone to be injured by them than normal. Malarial affections may leave marked or total deafness when no quinine has been given: and many a case has unjustly drawn blame upon the physician because he has given quinine when his only error, if any, has been in giving too little. Just as in the tympanic inflammations, stasis must be overcome at times, and quinine is often our best, if not the most comfortable, means to this end. As the prejudice against it is widespread, however, great caution must be employed in its use; even those with anæmic tinnitus, who find prompt relief from its exhibition, showing sometimes the greatest reluctance to take it.

Akin, perhaps, to these cases are the losses of hearing following mumps, diphtheria, and other acute affections. They can, perhaps, be best compared to the blindness following ptomaine-poisoning from sausage and such foods. There is certainly microbic invasion of the labyrinth in some of the diphtheritic cases: but these are apt to show the more usual septic inflammatory reactions. Acoustic atrophy, like that of the optic nerve, generally calls for an alterative course to limit and repair, if possible, the ulterior lesion, followed by vigorous strychnine stimulation.

Occupation-deafness.

Finally, the matter of "occupation-deafness" demands our consideration, since it offers a valuable field for prophylaxis. "Boilermakers' deafness" is met among workmen in many trades where noise is great and continuous; but the riveter inside a boiler is naturally the most prone to suffer with the effects of such concussion upon his acoustic apparatus. Tampons have been employed with slight palliative effect; but the sufferer had best change his work to a safer one. Tympanic affection may be coincidently active and demand appropriate treatment, but should not blind us to the deeper condition. The rapid-fire automatic gun is likely to claim many victims in this way, just as the dentist's electric hammer paralyzed the nerve-supply of many teeth before its dangers were recognized. So, too, the various methods of persistent pneumatic or phono-massage have wrought much damage already and are likely to find countless victims yet, who are misled by a brief stimulation of the torpid nervous apparatus and press on with the measure until all acoustic reaction is exhausted.

Tinnitus.

Tinnitus is a symptom rather than an affection, as to which much remains to be learned. Where it is high pitched and of long standing little expectation of its disappearance should be raised; but it ought to be generally possible to reduce it to a mild annoyance. It is at times strictly cerebral; may be due to turbinal pressure in the nose; but is generally of tympanic origin and can be benefited by treatment of the coincident deafness. Yet it may have no relation to the defect of hearing, occurring when

it is unthreatened or persisting after it has been restored. General vascular conditions must be looked to in the blowing type of noises, and dietetic rather than medicinal measures resorted to. Pneumatic massage, most easily employed with the finger-tip, will often do much for its relief.

Use of Delstanche's rarefacteur advised in labyrinthine disturbance due to sudden loud noises or explosions for the purpose of restoring to a normal position the indriven tympanic structures and stapes. Pilocarpine is not contra-indicated in inflammation of the auditory nerve due to meningitis, but, on the contrary, is to be recommended in recent cases in view of the fact that the labyrinth is usually implicated. In the use of the galvanic current in cases of nervous tinnitis the positive pole should be applied to the tragus. When one ear only is being galvanized the current should not exceed from 2 to 4 milliampères, and it is only when the current is divided between the two ears, both being treated at the same time, that it is at all advisable to double the strength of the current. Dundas Grant (Lancet, Aug. 24, Sept. 14, '95).

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INTERTRIGO.

Definition.—Intertrigo is an hyperæmic affection of the skin characterized by an erythematous condition produced upon contiguous surfaces, accompanied with an exudation of sweat with maceration of the skin.

Symptoms.—Intertrigo is produced through closeness of contact between two opposing surfaces The juxtaposition may cause irritation whether assisted or not by friction. It is an affection of hot weather, but may also occur in the winter. Heat acting directly on the subject and thus indirectly upon contiguous areas assists in its production and extension. It occurs in regions such as the nates, groins, axillæ, the spaces between and beneath the breasts in the female or in corpulent males, as well as overlapping portions of the abdomen, the sulci of the fingers and toes and, in fact, any redundant portion of skin.

At first there is only an erythematous blush, but this soon increases in degree and in extent. Prolonged contiguity may lead to a true traumatic erythema, which with the retained sweat causes maceration of the adjacent portions of skin. If allowed to continue, the maceration may extend and end in a true inflammatory process. In infants intertrigo is apt to be an annoying affection, especially when it occurs through inattention of the parts after micturition and defecation. Eczema is likely to supervene if no attention be given. The rubbing is also encountered after horseback-riding, rubbing of tight-fitting boots or clothes, etc. (erythema paratrimma).

The parts are hot and tender, if not actually painful, and movement causes a scraping sensation. In an unattended case bleeding may occur as a result of fissures and removal of the upper layers of the epidermis. The parts emit a disagreeable odor, and according to Crocker, of London, stain—but do not stiffen—linen: a point which this author adduces as of diagnostic value between eczema and intertrigo.

Diagnosis.—The diagnosis of this condition is not difficult. The fact that there are two opposing surfaces in which there is a retention of sweat, emitting a disagreeable odor, and causing maceration and fissuring of these surfaces, should be sufficient in most cases. Removal of the cause is generally followed by an early cessation of the symptoms. Eczema will persist for shorter or longer periods, according to the extent of sur-

face involved, and not alone will remain in position, but will also increase, if not judiciously treated. In the latter affection there is some degree of infiltration and thickening, which does not occur in erythema intertrigo unless eczema complicates the process. Congenital syphilis may also be confounded with this affection, but the fact that syphilis extends far beyond the borders of the contiguous surfaces will generally suffice to prevent error. Syphilis also produces a darker discoloration. An "*erythème syphilidiforme*" is noted by A. Fournier, which begins as a papulo-vesicle and resembles the vaccine-papule; but, as these lesions are to be found in repeated succession, error is hardly possible.

Etiology.—The causes of intertrigo are manifold. Warm weather or heat produced by artificial means during the winter season may act as an inducing factor. Exaggerated exercise, rowing, running, horseback-riding, as well as sedentary habits as observed in clerks who sit for long periods on leather-cushioned stools, or persons who wear unsuitable undergarments, and sweating at contiguous points are known causes. Friction, with or without moisture, will induce it. Secretions—such as saliva (the cases, for instance, following repeated protrusion of the tongue and licking the parts), vaginal discharges, unremoved fæces during the existence of a diarrhœa, the dribbling of urine and the complication of glycosuria—are as many etiological factors. Many other conditions contribute to assist in its production and extension, such as the milk upon the garments of careless mothers, which, thus being allowed to dry, roughens and stiffens the dressings; so that rubbing is soon induced. In young infants improperly-washed diapers are also causative media.

Treatment.—As a rule, little or no treatment is required. Removal of the cause will usually end in early recovery. Inattention to the parts may allow the case to proceed to a high grade of inflammation. The first indication is to remove, by means of some bland soap—Castile or glycerin soap—and water, the foreign elements acting as irritating factors, and immediately afterward dry with a soft towel. An odor may require the addition of a slight quantity of carbolic acid or thymol. Bland dusting-powders are very useful; but if allowed to remain and absorb the discharges they induce an aggravation. Boric acid, talc, fullers' earth, lycopodium, or starch in impalpable powder relieves both pain and irritation. Solutions are often more grateful, but must be applied almost continuously to obtain good effects. Boric acid in saturated solution is one of the best agents. Sulphite and hyposulphite of sodium in water in the strength of from $^1/_2$ to 1 drachm to the ounce are often beneficial. Astringent washes give excellent results. Acetate of lead (3 to 5 grains to the ounce of water), sulphate of zinc (1 or more grains to ounce of water), acetate of zinc (in similar proportions), bichloride of mercury (1 to 2 grains to 1000 parts of water), calomel (3 to 5 grains to the ounce of lime-water—*lotio nigra*) are all efficacious. A useful method is to apply one of the above lotions for a period of fifteen minutes, then to thoroughly dry the parts by mopping them: and to follow this by one of the dusting-powders. This should be carried out three or more times during each half of the twenty-four hours. In addition to the remedial measures the parts must be kept apart by means of medicated lint or cotton: a procedure which suffices in some of the cases observed. In obstinate cases it may be ad-

visable to place the patient in bed to keep the limbs apart until the acute phase of the trouble disappears.

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INTESTINAL OBSTRUCTION AND ANASTOMOSIS. See Obstruction, Intestinal.

INTESTINAL PARASITES. See Parasites.

INTESTINES.

Duodenum, Inflammation of.

Synonyms. — Duodenitis; duodenal catarrh.

Symptoms.—While the possibility of isolated inflammation of the duodenum cannot be denied, it is probable that the condition is usually associated with inflammation of the stomach, on the one hand, and of the remainder of the small intestine, on the other hand. Among the symptoms are pain, distress or discomfort in the right upper quadrant of the abdomen, impaired appetite, bad taste, coated tongue, discomfort from two to four hours after taking food, with eructations and flatulent distension. There is likely to be nausea and at times there is vomiting, with bilious fluid in the ejecta. As a rule, the bowels are constipated, though there may be diarrhœa. Often, also, there is jaundice, from extension of the catarrhal process to the choledoch-duct and resulting obstruction to the flow of bile, with clay-colored stools, etc. There may be, further, weakening and despondency, and possibly slight elevation of temperature. Acute or subacute attacks may last two or three weeks, chronic attacks for as many months.

The condition is not a serious one, and recovery is usually prompt upon institution of the proper therapeutic measures.

Etiology.—The causative influences include, in a general way, irritants generated within the body, as from fermentation or autointoxication; or introduced from without, as milk, food, or by accident, or possibly by design.

Treatment.—The treatment consists primarily in a regulation of the diet, with rigid restriction as to both quantity and quality of food, and perhaps temporary abstinence, and recumbency in bed, when the symptoms are acute. From 6 to 8 ounces of milk, peptonized or pancreatized if not well digested without preparation, may be given every three hours. Unirritating broths and soups, strained gruels, farinaceous foods, boiled rice and soft-boiled eggs, albumin-water, and barley-water may also be permitted. Solid food, and especially the coarser vegetables and fruits, which leave considerable residue, are particularly to be avoided. Small doses of calomel, $\frac{1}{6}$ grain, may be given at hourly intervals for a short time, followed by a saline, such as the compound effervescing (Sedlitz) powder, sodium phosphate, sodio-potassium tartrate; or the saline may have been given alone at the outset. Counter-irritation, as with a mustard-plaster, in the right hypochondrium, may relieve pain and allay nausea and vomiting. If diarrhœa be present the salts of bismuth will be indicated, of the subcarbonate and subnitrate, from 10 to 20 grains; or the salicylate or subgallate from 5 to 10 grains.

Duodenum, Ulceration of.

Symptoms.—The clinical manifestations of ulcer of the duodenum are variable and but little characteristic. The condition may, in fact, give rise to no symptoms and be discovered only upon post-mortem examination or through the

occurrence of hæmorrhage, perforation, suppuration, peritonitis, stenosis of the bowel, dilatation of the stomach, or jaundice.

> Case of a man, apparently in good health, who was seized during the night with sudden, extreme diffuse pain in the abdomen. He died next day. At the autopsy a large oval ulcer was found in the anterior wall of the pyloric orifice. Such cases are probably not rarely mistaken for strangulation of the bowel, but the rapidity with which collapse sets in should nearly always serve to distinguish them from strangulation, in which collapse develops more gradually. Wilberforce Aikins (Canadian Pract., Dec. 16, '91).

Such symptoms as are present resemble closely those of ulcer of the stomach. The most pronounced and the most distinctive of these is pain in the right hypochondrium, which is usually less acute than that of gastric ulceration, and is likely to appear later after the taking of food, viz.: two or three hours or more.

> The symptoms of duodenal ulcer differ but little from those which are met with when the disease occurs in the stomach. Pain is much oftener absent in the duodenal disease.
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> When present, it is often extremely severe, making the patient writhe while it lasts; it may occur at regular intervals, without reference to food; or, if due to food, it is said to begin from two to four hours after the meal, but may, doubtless, occur as early as half an hour. The occurrence of such pain in the right hypochondrium, in absence of other symptoms, is considered sufficient by some to establish a diagnosis of duodenal ulcer.
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> As to the significance of hæmorrhage, in the absence of causes, in the lower bowel, sudden profuse discharge indicates strongly the duodenum as the seat of bleeding, as do also repeated small bleedings; in the latter case the blood is all tarry. In gastric hæmorrhage, if small, the blood passed by the bowel will probably be found more altered by the action of the gastric fluid, and, if large, the vomiting will be more prominent than the alvine evacuations; while the converse probably holds true when the bleeding is duodenal. Wilson Fox ("Reynolds's System of Med.," '91).

The pain is at times spontaneous, and it can usually be induced or intensified by pressure. At times it recurs in severe paroxysms, radiating to the epigastrium and the sacrum. At other times there is only a sense of vague discomfort or of pressure or of tension. Occasionally there is a feeling of hunger, of gnawing, of corrosion, or of the presence of a foreign body. Rarely a tumor can be felt. The appetite may be unaffected and the bowels regular. Dyspeptic symptoms, if present at all, are not pronounced. Exceptionally there is diarrhœa, but more commonly there is constipation. Vomiting is not usual, but when it does occur, it takes place usually after a paroxysm of pain or in consequence of a complicating gastric disorder or perhaps of cicatricial stricture of the duodenum close to the pylorus. Unless the vomitus contain blood it is not distinctive. Hæmorrhage is one of the more common symptoms, and it may be slight or copious. The blood may be vomited, or it may be passed by the bowel, or it may be expelled in both these ways. The loss of blood may be sufficient to cause death without the escape of blood externally. Jaundice occurs rarely and may then be attributed to cicatricial constriction of the choledoch-duct. The disorder may be of long duration and recurrence is not rare after recovery has taken place. Death may result suddenly from perforation or hæmorrhage.

> Certain signs indicate the occurrence of intestinal perforation before peritonitis manifests itself. The cardiac and respiratory murmurs can be heard distinctly on auscultation of the abdomen,

the phenomenon being due to the presence of intestinal gas in the peritoneal cavity; a more important sign, however, is the modification in the pulse, the beginning of intestinal perforation being marked by an acceleration, which is followed within a few hours by slackening. The latter, due to the absorption of putrid gas's acting as a cardiac poison, is, apart from its diagnostic significance, of considerable importance from a surgical point of view, indicating the most opportune moment for operation. L. A. Gluzinski (La Semaine Méd., Nov. 6, '95).

Diagnosis.—The diagnosis may be attended with much difficulty; in fact, the condition may escape detection. The pain and tenderness of duodenal ulceration are situated rather more to the right than that of gastric ulceration, while the pain induced by the taking of food occurs, as a rule, later with the former than with the latter; and when hæmorrhage occurs the blood is more likely to be passed by the bowel than to be vomited. From malignant disease ulceration of the duodenum is to be differentiated usually by the absence of a tumor and of cachexia and by the greater likelihood of hæmorrhage, by the acidity of the gastric juice, with the presence of free hydrochloric acid. The paroxysms of pain may simulate biliary colic, but with the latter jaundice is more common, the symptoms of digestive derangement are less pronounced, the symptoms in general, or their aggravation, are less related to the taking of food, and there is an absence of emesis and of hæmorrhage from the bowel.

There is great probability of duodenal ulcer when a patient, apparently in good health, has melæna or hæmatemesis, with pain just under the liver, to the right of the median line, a few hours after eating, with no gastric disturbance and a prompt return of appetite after the hæmorrhage. Collins (Revue Inter. de Bibliog., June 10, '94).

Etiology and Pathology.—Ulceration of the duodenum is analogous to the same lesion as it occurs in the stomach, and it has much the same etiology, pathology, morbid anatomy, and treatment. The process is, however, much less common in the duodenum than in the stomach, in a proportion, as given by various authorities, varying from 1-9 to 1-40. Sometimes ulceration is present in both stomach and duodenum in the same case. The condition is due, in the majority of cases, to the action of the gastric juice upon portions of the mucous membrane whose vitality is lowered by any one of a number of conditions, viz.: venous stasis, hæmorrhage, ischuria (thrombosis, embolism, vascular spasm, arteriosclerosis), hyaline degeneration of the walls of the arteries, traumatism, etc. The affection is observed most commonly between the ages of 20 and 60, the prevalence being fairly equal in several decades. Occasionally it is encountered in infants. Males suffer in larger number than females, the proportion being given as 3 to 1.

In investigating the records of 17,652 post-mortem examinations at Guy's Hospital the authors found 70 cases in which there was an ulcer of the duodenum, either open or healed. It is much rarer than gastric ulcer.

The authors' cases give a proportion of 52 males to 17 females, or, if burns be excluded, 48 males to 16 females,—a ratio of 3 to 1. The total of the collected cases gives 109 males to 48 females, or, excluding burns, of 100 males to 30 females. Thus, while duodenal ulcer is three times as common in males as in females, gastric ulcer is twice as common in females as in males. Perry and Shaw (Guy's Hosp. Reports, vol. l, p. 171).

The lesion is commonly situated close to the pylorus. Usually there is but a single ulcer; occasionally there are more. The ulcer varies in size and depth.

The simple ulcer of the duodenum is usually round. Sometimes, however, it is oval, angular, or even irregular. In size it is most variable. Generally, the ulcer is more or less perpendicular to the walls of the intestine. When the ulcer is very chronic, the cicatricial contraction occasions considerable deformity of the adjacent parts. Extension to the neighboring arteries appears to occur in the following order of frequency: the pancreatico-duodenal, the right gastro-epiploic, the hepatic, and then the pancreatic artery. Perforation is the complication most to be dreaded. In 262 cases perforation occurred 181 times. Collin (Thèse de Paris, '94).

In the process of cicatrization it may cause stenosis of the bowel, or, if situated close to the papillæ of Vater, it may in the same way cause obstruction of the choledoch and pancreatic ducts. The portal vein may suffer obstruction from a like cause, with the development of thrombosis and the attendant train of symptoms. The ulcer may perforate into the peritoneal cavity and thus cause death from shock or diffuse peritonitis; or by erosion of a blood-vessel it may give rise to copious hæmorrhage. Perforation may also take place into an adjacent viscus, or through the abdominal wall, giving rise to the development of subcutaneous emphysema or the formation of a duodenal fistula. Often there is circumscribed peritonitis about the site of the ulcer, with adhesions to contiguous organs. Carcinoma develops at times in the seat of previous ulceration of the duodenum.

Prognosis.—The prognosis, while perhaps a little uncertain, is, on the whole, favorable, providing the disease is recognized and intelligently treated. There is, of course, the danger of fatal hæmorrhage as well as of perforation and peritonitis, while recurrence is not rare, and carcinoma may develop at the site of previous ulceration. The affection is sometimes exceedingly unyielding to treatment, and its duration may be protracted.

Treatment.—The treatment does not differ essentially from that laid down for gastric ulcer, and includes rest in bed; a bland, unirritating, nutritious diet, including especially predigested milk; and the administration of alkalies, preparations of bismuth, and iron. Hæmorrhage will demand absolute rest, abstinence from food by the mouth, and the administration of opium and perhaps also of ergot. The local aplication of an ice-bag may prove serviceable. A single copious hæmorrhage or repeated free bleeding may justify surgical intervention and cauterization or ligature of the bleeding point. There is justification, further, for excision of the ulcer to remove the possibility of the subsequent development of carcinoma.

Case of perforated duodenal ulcer cured by operation. A. Landerer and Gluecksmann (Mit. aus den Grenzgebieten der Med. Chir., B. I, H. 2).

Burns of the surface are sometimes attended with ulceration of the gastro-intestinal tract, most commonly in the duodenum, but occasionally in other portions. (See BURNS, volume ii.)

Ulceration of the duodenum after burns is due to septic infarction of the vessels of the duodenum, the gastric juice then acting upon the parts cut off from the vascular supply. Marmaduke Sheild (Brit. Med. Jour., Oct. 27, '94).

The usual seat in the duodenum is the superior horizontal portion not far from the pylorus. There may be a single ulcer or several. The lesion may assume all grades of severity, from a simple erosion to deep loss of substance. There may be, besides, diffuse inflammation of the mucous membrane. The process is a rapid one and it may quickly cause death; al-

though, on the other hand, the symptoms may be deferred for some time.

Ulceration of the duodenum may occur also from other causes, such as embolism, thrombosis, as in the course of endocarditis, atheroma, pulmonary abscess, amyloid disease, catarrhal or follicular disease, or tuberculosis.

Cæcum, Diseases of.

Synonyms. — Typhlitis; cæcitis; inflammation of the cæcum; paratyphlitis; perityphlitis.

Symptoms. — The most distinctive symptom of typhlitis is pain or a sense of discomfort in the right iliac region. With this there is, as a rule, associated constipation, although there may be diarrhœa. The appetite is likely to be impaired, the tongue to be coated, the breath to be offensive, a bad taste to be present, and there may be tympanites, as well as nausea and vomiting. The temperature is but little affected and the constitutional disturbance is inconsiderable. The presence of fæcal masses in the bowel may give rise to a palpable tumor, yielding dullness on percussion. Extension of the disease-process to the appendix will induce additional symptoms elsewhere described as characteristic of this condition. Inflammation of the connective tissue or of the peritoneum surrounding the cæcum will be attended, in addition to febrile manifestations and a general aggravation of existing symptoms, with a sense of doughy induration on palpation, on the one hand, perhaps progressing to suppuration, with the possibility of rupture into the peritoneal cavity; and, on the other, with the development of signs of peritonitis, which may remain localized or become diffuse.

Diagnosis.—The diagnosis of typhlitis is to be made from the mildness of the symptoms, and the readiness with which they yield to appropriate treatment, and the absence of evidences of constitutional disturbance. As has already been intimated, the differentiation from appendicitis is exceedingly difficult and oftentimes impossible, by reason of anatomical peculiarities. Appendicitis, comparatively, may be looked upon as the graver of the two conditions, and its symptoms may be considered the more marked and the less yielding to treatment. Under favorable conditions it may be possible to distinguish by palpation between an inflamed cæcum and an inflamed appendix. It is doubtful if paratyphlitis and perityphlitis are to be differentiated from para-appendicitis and periappendicitis. (See APPENDICITIS, volume i.)

Etiology.—Isolated inflammation of the cæcum is probably an uncommon condition, if it occur at all. On the other hand, typhlitis will be found, as a rule, to accompany enteritis and colitis, and also appendicitis, with the symptoms of each of which its own symptoms are likely to be blended.

> Cause of all typhlitis and perityphlitis and paratyphlitis assigned to an inflammatory process in the appendix, due to its occlusion either by fæces, fæcal calculi, stricture, or, more seldom, foreign bodies. Schede (Deut. med. Woch., June 8, '92).
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> Perityphlitis is unusually common in America, due to two of our natural failings: eating too much and chewing too little, the result of which is constipation. Lange (N. Y. Med. Jour., June 6, '91).

The cæcum may, with the adjacent bowel, be the seat also of tuberculous, syphilitic, typhoid, or dysenteric infiltration, and perhaps secondary ulceration. The symptomatology attributed in the past to syphilis was largely constructed from the manifestations of what we have learned to recognize as appendicitis. At the same time, the pos-

sibility of catarrhal inflammation of the cæcum cannot be denied. Such a condition may arise in consequence of the presence of irritants, either introduced from without or generated within the body: but, as has been stated, the responsible agencies do not confine their activities to the head of the colon. The long-continued presence of hardened fæcal masses in the cæcum may cause irritation and give rise to ulceration, with the development of either paratyphlitis, inflammation of the connective tissue surrounding the cæcum; or perityphlitis, inflammation of its peritoneal covering; and these may be responsible in time for more remote complications. This train of events, it may be concluded from the experience of recent years, is like typhlitis itself, rather uncommon, so-called paratyphlitis being in the vast preponderance of cases para-appendicitis and periappendicitis.

Prognosis.—The prognosis of simple catarrhal typhlitis is favorable. Recovery is the rule under judicious treatment, though recurrence may take place on renewal of the provocative conditions. The prognosis is rendered grave by the development of paratyphlitis and graver by that of perityphlitis, both of which may lead to fatal suppurative peritonitis.

Treatment.—The treatment of typhlitis is essentially an eliminative and antiphlogistic one, and will be partly medicinal and partly dietic. It is best, even in mild cases, for the patient to go to bed, and be placed under conditions of rest and quiet. The diet should be bland and unirritating, and so constituted as to give rise to the least residuum possible. A suitable dietary can be constructed with milk as a basis, and including soft-boiled eggs. Vegetables and solid food in general had better be avoided. If the stomach be irritable, food may be withheld entirely for twenty-four or even forty-eight hours. As constipation is the rule, the bowels are to be moved, and preferably by means of enemata given with the aid of a fountain-syringe. For this purpose, a quart or two quarts of simple warm water may be used; or soap-suds may be added; or 1 or 2 ounces of castor-oil, or olive-oil, or cotton-seed oil, or oil of turpentine, perhaps emulsified with the yelk of an egg. If the constipation prove obstinate, irrigation of the bowel with larger quantities of water may be practiced.

> The best treatment of perityphlitis is removal of the intestinal contents in every possible way, especially by washing out the stomach. If the stomach is washed out soon after the onset of fæcal stoppage, the fæcal masses removed, and this done two or three times daily, the intestines may be relieved, and the decomposition of their contents and absorption of toxic substances prevented. Good effects from this treatment repeatedly observed. Ewald (Berl. klin. Woch., No. 18, '91).

When the constipation has been overcome small doses of calomel, $^1/_6$ grain hourly for six doses, followed by a saline —magnesium sulphate, sodio-potassium tartrate, sodium phosphate, from 2 to 4 drachms, may be given; or, if the constipation was aggravated originally, the saline may have been given at the outset, preceded or not by 5 grains of calomel. If the bowels be loose and pain be a prominent symptom, opium may be indicated, though deceptive masking of the symptoms by the anodyne is to be guarded against.

The development of paratyphlitis and perityphlitis will demand, in addition to the measures already specified, local applications, preferably of cold, or, if that be badly borne, of heat: and counter-irritation and sorbefacient ointments

when the process manifests a tendency to become chronic.

Medical treatment of perityphlitis defended against surgical interference. The plan of treatment is rest, free evacuation of the bowels, hot fomentations or ice-bags, with the addition, in chronic cases, of repeated blistering over the tumor. Saundby (Birmingham Med. Review, Sept., '91).

Results in 65 cases of perityphlitis. Thirty-four cases were cured, 25 improved, 2 uncured, 3 died, and 1 transferred. In the commencement the treatment is antiphlogistic: leeches (up to ten) are first applied, and then ice or Leiter's coil. When cold does not agree, then warmth in the form of a mush poultice is applied. Later the parts are painted with iodoform collodion, to which equal parts of the tincture of iodine and tincture of nut-galls have been added. To hasten absorption, sapo viridis is rubbed in. The diet is to be attended to and compound tincture of cinchona given; also, opium,—not in all cases, however. As the affection subsides, if the bowels do not move spontaneously, enemas may be given, or compound licorice powder or Carlsbad salts. For chronic cases with persistent exudate, warm, moist applications with massage are advised. Purgatives should also be employed. Operation is to be advised when pus is demonstrated to be present. J. Vollert (Deut. med. Woch., Aug. 13, 20, '91).

In cases of indolence of the cæcum external treatment, friction and massage of the abdomen, with the continuous current, if necessary, are employed, and if there is any congestion of the cæcum or pericæcal ganglia the parts are painted with tincture of iodine or small blisters applied. The diet is of great importance, and no solid foods should be taken, but meats, fish, etc., be reduced to a fine pulp, and vegetables be given in the form of a *purée*. Jules Simon (Revue Gén. de Clin. et de Thér. Jour. des Prat., Jan. 19, '95).

Suppuration will and peritonitis may demand surgical intervention. (See APPENDICITIS, volume i.)

When there is severe localized pain, tenderness, and a tumor present in the right iliac region, with the constitutional symptoms of suppurative inflammation, an early operation is demanded to evacuate the pus. This should be done as early as the third day when possible. Delay is more dangerous than operation. R. Winslow (Va. Med. Monthly, May, '91).

One ought not to seize on and explore every perityphlitic abscess, more particularly when the proof of its existence is doubtful and only a mere suspicion. When general peritonitis sets in as a complication, surgical treatment is necessary. Ewald (Berl. klin. Woch., No. 18, '91).

Resection of the cæcum recommended when it is perforated. Von Winiwarter (Annales de la Soc. Médico-chir., June, '92).

Colon, Dilatation of.

Symptoms.—Apart from the symptoms of any primary condition that may be operative, dilatation of the colon is characterized especially by distension of the abdomen of varying degree, yielding a tympanitic note on percussion. Constipation, further, is a prominent feature, and may be marked. Sometimes there occur in association numerous small, liquid stools, together with ungratified desire for or ineffectual effort at defecation. There is also general discomfort in proportion to the degree of distension and the resulting displacement and interference with function of adjacent organs. Bladder, uterus and appendages may be crowded into the pelvis; lungs, liver and heart pushed high up into the thoracic cavity. Digestion is naturally deranged, nutrition suffers, weight is lost, and the quality of the blood deteriorates.

The symptoms of atony of the intestines are marked constipation, headache, vertigo, nausea, and pains in the back and loins. Nervous symptoms are often present. The signs are marked tympany

and sometimes the ability to detect the distended colon and fæcal masses by palpation. By giving an enema of 6 1/2 to 9 1/2 fluidounces of water, splashing can be heard, while normally 1 pint will be required to produce the sound. Friedenwald (Med. News, Aug. 11, '94).

Introduction of a large quantity of water into the intestine in order to diagnose a condition of atony or dilatation recommended. From 1 to 1 1/4 pints are necessary in order to produce the splashing sound in the normal intestine, perceptible in the neighborhood of the transverse and descending colon; while only 3/5 or 4/5 pint will produce the sound if there is atony or dilatation; and in such a case it is perceptible first in the sigmoid flexure, then in the transverse colon, and finally in the entire large intestine. Change of position produces a succussion-sound, and dilatation of the sigmoid flexure may be ascertained, which may be beyond the median line. In the same manner displacement of the transverse colon may be determined, and if simple atony only is present the splashing will be heard in the normal position of the colon, while if there is also displacement the sound will be heard under the umbilicus. It is indispensable to evacuate the intestine with a purgative before performing this lavage. In catarrh of the intestine the water will return charged with mucus and false membrane, while if the intestine is normal the water will be clear or will contain only some slight epithelial *débris*. Boas (Deut. med. Zeit., Jan. 15, '95).

Etiology.—Dilatation of the colon may arise from a variety of causes, the essential element being invariably an atonic state of the muscular coat of the bowel.

This may result from long-protracted catarrhal conditions, from fæcal accumulation, and from other forms of chronic intestinal obstruction, such as the presence of neoplasm, or of a foreign body, or of constriction from without or within, and the like.

Atony of the intestine separated from chronic constipation, which is often only a symptom of the former condition. The atony usually affects the colon, which is unable to expel the fæces. It may be primary, as the result of improper diet, sedentary habits, or a too frequent use of cathartics; or it may be secondary to many disorders, as obesity, disease of the heart, lungs, or liver, typhoid fever and other intestinal diseases, or organic nervous diseases. It is often found in childhood and may be congenital. Friedenwald (Med. News, Aug. 11, '94).

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In cases of marked tympanites the distension is practically confined to the large intestine, and it would appear that the obstruction to the escape of flatus is due to the downward pressure of the descending colon and sigmoid flexure upon the upper portion of the rectum, forcing the folds of Houston one upon the other, and bringing about, in this way, what is for the time in effect an impermeable stricture.

The most rational method of relieving this obstruction and liberating the imprisoned gas is the inversion, or partial inversion, of the patient, and removal through the aid of gravitation of the pressure from above, which has converted the mucous folds referred to into an absolute obstruction.

While the knee-chest position may answer best in cases of extreme distension, the placing of the patient upon the side, with elevation of the foot of the bed, will commonly secure relief in cases of moderate distension. Lesslie M. Sweetnam (Annals of Surg., Mar., '96).

At times the condition is present from early life and in rare instances it has been thought to be congenital.

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Case of a child, 3 1/2 years of age, male, who from birth was extremely constipated. No action of bowels without purgatives. For the first year there was no enlargement of abdomen, and the child was in no pain. At the end of the first year gradual and progressive enlargement of the abdomen supervened.

At the age of 3 1/3 years constipation

became alarming, and no flatus was passed. The distension and pain became more marked than ever before, while purgatives and enemata seemed useless.

On admission to the hospital the abdomen was much distended and uniformly enlarged. There were vermicular movements over the lower part of the abdomen, apparently associated with the distended colon. This colon could be felt as an elongated prominence, running obliquely across the abdomen, and varying in position from time to time. Movements were both spontaneous and excited by examination. Laparotomy was performed, no stricture found. A second operation in the left inguinal region, in order to empty the colon, met only with partial success, it being impossible to really empty the intestine. Five days later the patient showed signs of perforative peritonitis and died. At the autopsy, there was a little recent peritonitis. "The lower half of the abdomen is occupied by the enormously distended and hypertrophied sigmoid flexure, which lies completely across the abdominal cavity with the concave border looking to the left. The upper half of the loop is the wider and longer, measuring 20 centimetres by 8 centimetres, while the lower half is 15 centimetres long by 5 centimetres in diameter. . . . There seems to be a thickening of that part of the mesocolon which approximates the two ends of the loop and causes traction on the lower end, thus creating a partial narrowing of the lower portion." The wall of sigmoid and descending colon was much thickened; there was no ulceration. Idiopathic dilatation of the colon is a rare condition.

Cases fall into four categories: (1) the rarest, those undoubtedly of congenital origin, of which the author's case is only the fifth on record; (2) those in which the symptoms come on a few months after birth—these cases are closely allied to the preceding; and (3) those developing some years after birth, but distinct from (4) those only occurring in adult life. The cause regarded as being purely mechanical. The whole of the colon may be dilated, but the sigmoid flexure is almost invariably affected, and from this point the dilatation spreads backward to a varying extent of the colon. Treatment has been most unsatisfactory. Purgatives and enemata have little effect, and lead to increased suffering, while massage is dangerous. C. F. Martin (Montreal Med. Jour., Mar., '97).

Fig. 1.—Photograph of a boy, aged 3½ years, with congenital idiopathic dilatation of the colon.

When dependent upon obstruction, of whatever character, it follows hypertrophy in consequence of the constant efforts at expulsion of the accumulating contents. In some instances no form of obstruction has been discovered, and it

may be that in these the condition may have been dependent upon an hypoplasia of the muscular coat of the bowel. The gut may attain enormous proportions and it may undergo extraordinary displacement and distortion.

Case of gigantic intestinal diverticulum seen in a boy aged 14. The abdomen began to swell soon after birth and continued till death, which followed an operation for relief of the condition. It was found at the autopsy that a large diverticulum connected with the rectum. Maas (Centralb. f. Gynäk., Apr. 22, '88).

Case in which sigmoid flexure formed two large sacs extending across the abdomen. Money (Brit. Med. Jour., Feb. 4, '88).

It also becomes the repository for a vast accumulation of fæcal matter, and it may, through acute dilatation of the bowel, attend inflammation of the peritoneum or this mechanism lead to a fatal issue of some organ with a peritoneal covering.

Treatment.—The treatment consists in the prevention of the causative conditions when possible, of their removal when present, and of their effects when these have developed, with a proper regard, of course, for the general state of the patient. Thus, constipation is to be prevented by attention to and regulation of the diet, and to be judiciously corrected when it exists, though the abuse of purgatives is to be carefully guarded against. Accessible strictures should be dilated, obstructing neoplasms and foreign bodies removed, and constricting bands and confirming adhesion freed. The fæcal accumulations are best removed by enemata of either water, warm or cold, alone, or with the addition of soap-suds, castor-oil, olive-oil, cotton-seed oil, or turpentine.

Large quantities of olive-oil, varying from a pint to a quart, in divided doses, have been successful in fæcal accumulations. E. W. Mitchell (Cincinnati Lancet-Clinic, Jan. 17, '91).

Massage is capable of effecting good results in suitable cases, and electricity also at times. The diet should be preferably concentrated, and food requiring intestinal digestion, or giving rise to a bulky and coarse residue, must be avoided. Of drugs, strychnine is, perhaps, the best, conjoined or not with belladonna, in accordance with the presence or absence of irritability of the bowel.

Enteroptosis. — Descent of the intestines from their position is a frequently overlooked condition occurring coincidently with gastroptosis, nephroptosis, and prolapse of other abdominal organs. It constitutes the disorder termed by Glénard "splanchnoptosis." In rare cases the condition may be congenital. Predisposing causes may be relaxation of the abdominal walls from numerous pregnancies or from rapid emaciation; traumatism; improper use of cathartics; and, in addition to these general causes, there must be in every case a relaxation of the ligaments and the mesentery. The condition, even when extreme, may be without symptoms, but usually there exist signs of disordered functions, which may affect the general nutrition. The appetite is generally lessened, and there are sensations of weight and fullness, with acid eructations. In some cases the bowels move daily, but more often constipation prevails, sometimes alternating with diarrhœa. Excessive flatulence is usual, and not rarely there is membranous enteritis. As a result of these abnormal conditions there are loss of flesh and a feeling of weariness, and the patient has the appearance of one suffering from a wasting disease. Nervous symptoms are marked, with headache, loss of sleep, and other sensations, which

might lead to a diagnosis of neurasthenia or hysteria. The course of the disease is chronic. (Boas.)

Colon, Inflammation of.

Synonyms.—Colitis; catarrh of the colon.

Definition.—Inflammation or catarrh of the colon may be part of the same process involving other parts of the intestinal tract as well, or it may be more or less localized to the large bowel.

Symptoms.—These differ in accordance with the nature and the continuance of the causative agent and with the extent and intensity of the morbid process. The most distinctive manifestation is looseness of the bowels. There may be many movements hourly. The stools are usually small and they commonly contain mucus; at times they are large and contain much fluid. They may be blood-streaked. Often there is abdominal pain, of varying degree, and sometimes colicky in character. Not uncommonly there is some degree of tenesmus. There may be frequent ineffectual desire for stool. The temperature may be elevated, and in cases of acute onset there may be nausea and vomiting and marked constitutional depression. Appetite is generally lost, though in chronic cases it may be preserved. In long-standing cases nutrition fails and emaciation and weakness may be marked.

It depends, like other forms of mucous-membrane disturbance, upon the action of irritants, either generated within the body, such as the products of fermentation or other toxic substances resulting from some inadequacy of function, or introduced from without, such as indigestible or decomposing food, or an excess of food.

Mucous colitis, or mucino-membranous enteritis, is most often produced by some obstruction to the course of the fæcal matter resulting from hæmorrhoids, hernia, constipation, tumors, and other affections of the uterus and appendages, polypi of the rectum in the case of children, and hypertrophy of the prostate. There may be no symptoms whatever, or there may be symptoms resembling those of gastric dyspepsia or even dilatation. G. Sée (Le Bull. Méd., Dec. 27, '93).

Mucous colitis is associated nearly always with habitual constipation in young women the subjects of some gynæcological affection. There are two forms of the disease: the one depending solely upon the nervous system, the other in intimate relation to a uterine disease. Moran (Jour. de Méd., Jan. 21, '94).

Excessive intestinal putrefaction occurs in many conditions, especially epilepsy, chronic nephritis, anæmia, melancholia, etc. The amount of ethereal sulphates in the urine is an indication of the extent of fermentation. Herter (N. Y. Med. Jour., Jan. 27, '94).

Effect of temperature on intestinal fermentation studied, using the ethers in the urine as an indication of the extent of the process. Individual predisposition was found to exert a decided influence. A draught of air over the abdomen of a sleeper often increased fermentation, although some subjects were unaffected. Local chilling with ice always produced an increase of fermentation. L. Cantu (Centralblatt f. Bakter. und Parasitenk., Aug. 15, '94).

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Excessive intestinal fermentation or putrefaction, either from excessive formation of moderately-toxic bodies, or through the temporary appearance of bodies of greater toxicity, may cause various forms of toxæmia.

Many minor ailments are connected either with excessive intestinal fermentation or perhaps with modified intestinal fermentation, such as diarrhœa with offensive and perhaps fermented stools, and flatulence with abdominal pain and distension. Also anæmia, malnutrition, vomiting, headaches, the so-

called "biliousness," and many nervous manifestations. R. N. Chittenden (Dietetic and Hyg. Gaz., June, '96).

There are two forms of intestinal fermentation produced by micro-organisms, the one of the carbohydrates, the other of the proteids present in the gut, and they are mutually antagonistic to one another. The fermentation of carbohydrates leads to the evolution of gases, and to the formation of organic acids. The gases cause discomfort and the acids interfere with pancreatic digestion, but the products formed are not very poisonous nor irritating. On the other hand, the fermentation of proteid bodies caused by bacteria results in the formation of gases of more varied character, though in some cases no gas may be evolved, and in the production of many derivatives of a poisonous and dangerous action. The fæces are most offensive. In acute cases there are febrile symptoms; in chronic, depression, and nervous affections. Bartley (Brooklyn Med. Jour., Aug., '96).

It may be acute or chronic and of varying degrees of severity.

Prognosis.—The prognosis varies with the character of the causative agent and the general condition of the patient.

Treatment.—The treatment is best conducted with the patient in bed. Under such conditions recovery may follow mere restriction of the diet. This may include milk, strained broths and soups, beef-tea, beef-juice, farinacea, and possibly soft-boiled eggs. In aggravated cases it may be well to withhold all food for a time and give only albumin-water or barley-water.

When the condition is attributable to improper food or to the presence of irritating intestinal contents an initial dose of a teaspoonful each of castor-oil and camphorated tincture of opium may be given.

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Enterocolitis contra-indicates the use of drastic purgatives. Small doses of senna with hydrastis or hamamelis give good results, if there are bloody stools. Besides hygienic measures (massage, Swedish gymnastics) and regulation of diet, laxatives and enemata advised. One day a large enema may be given, and the next day 3 teaspoonfuls of castor-oil. The large injections must be given gently, the quantity may be 1 litre, 1½ litres, to 2 litres at the most. Solutions of borax or sodium chloride advised, but water containing boric acid or naphthol, which are irritants, condemned. When there are dysenteric stools the use of nitrate of silver in 1 to 3000 or 4000 advised. The diet must be free from irritating or easily-fermentable foods. M. Mathieu (Le Progrès Méd., June 12, '97).

Opium in some form, or morphine or codeine, may be required when the bowel-movements are unduly frequent and attended with distress or pain. The anodyne may be administered by the mouth or by the bowel in the form of an enema of starch-water with tincture of opium. In many cases irrigation of the bowel, from three to five times a day with from 1 to 3 quarts of fluid, serves a useful purpose. Simple warm water may be used or boric acid (5 grains to 1 ounce) or thymol (½ grain to 1 ounce) or silver nitrate (½ grain to 1 ounce) or mercuric chlorid (1 to 10,000) may be added in suitable proportion, care being taken that those solutions containing substances capable of toxic activity be not retained.

Large rectal injections, or injections of sufficient size to wash out the sigmoid flexure and colon, are not sufficiently resorted to, particularly in those cases of diarrhœa in which a catarrhal element is well marked. Good results are attained if large clysters are given by means of an hydrostatic syringe elevated not more than eighteen inches or two feet above the rectum. Salicylic acid and its relatives, nitrate of silver, iodoform when given in oil emulsion, and some of the vegetable astringents may

be employed in the water. The substance which has always given the writer the best results in the catarrhal cases is the sulphocarbolate of zinc in the proportion of 10 to 30 grains to an injection amounting to from 2 to 3 quarts. In some instances the water should be tepid, in others it should be as hot as the bowel can stand, and in still others it should be quite cold, the temperature of the injection depending largely upon the acuteness of the inflammatory process and the sensations of the patient. If the water be cold, care should be taken that undue chilling of the body does not result in feeble persons, or if hot, on the other hand, that a mild degree of heat fever is not produced. The success of this treatment depends absolutely, in many instances, upon the gentleness and care with which the injection is given, and the water must be allowed to trickle into the bowel rather than to enter it with any force.

In those cases of chronic diarrhœa in which the patient is markedly emaciated and unable to digest much food, so that the condition of impaired nutrition is an important factor in preventing recovery, this method of treatment is to be highly recommended, and it is worthy of note that a small rectal injection, amounting to an ounce or two of iodoform and sweet-oil emulsion, in the proportion of 5 grains to the ounce, injected into the bowel after a large watery movement has passed away, will relieve any tendency to tenesmus, and, by the absorption of a small amount of iodine, exercise a useful influence over the underlying catarrhal process. H. A. Hare (Therap. Gaz., Apr. 15, '95).

Two cases of ulcerative colitis cured by enemata of nitrate of silver, nitrate-of-silver capsules by mouth, and a low diet of oatmeal, milk, and whey. Rogers (Med. Review, Apr. 21, '94).

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Intestinal irrigation exercises no influence upon the course of tubercuious ulceration of the intestine. It is probably of little or no benefit in the ordinary cases of dyspeptic diarrhœa of infants, where the small intestine is wholly or mainly affected. It may be expected to exercise a beneficial influence upon the course of the disease in general cases of enterocolitis, and especially in those in which the colon is largely involved. It requires to be carried out with great caution, and more especially so in those cases in which there is considerable prostration. Clemow (Med. Press and Cir., Jan. 15, '96).

Laboratory experiments on dogs carried out to determine the effect of continuous intestinal irrigation on the pulse-tension, temperature, body and blood, renal secretion, and intestinal absorption. The irrigating fluid consisted of normal salt solution (1 drachm of salt to a pint of water). The following conclusions reached: 1. Pulse-tension: irrigate at 100°, 101°, 102° F., or even to 103°-104° F., if increase is to be avoided. If moderate increase is not objectionable, a temperature of 105° to 108° F. can be employed. If it is desired to rapidly increase it and to stimulate the heart, one may irrigate with a temperature of 110° F. and increase it steadily to 120° F. This is excellent in shock and allied conditions; before or during severe operation, to prevent shock; and from the commencement of chloroform anæsthesia, to prevent the sudden dilatation of the blood-vessels. Cold is a temporary stimulant, and cold irrigation will, for a time, markedly increase it: later, it is a depressant, and it fails. Cold should therefore be employed with caution. 2. Shock from hæmorrhage: irrigation with normal saline solution, 110° to 120° F., in this condition. With the double-current method, the patient receives a continuous enema at the desired temperature, and the quantity of the fluid can be absolutely regulated by the operator. 3. Temperature: hot irrigation, 110° to 120° F., when prolonged, increases the temperature of the body and blood.

Cold irrigation reduces temperature, but is depressing after twenty to twenty-five minutes. Cold irrigation has been employed with success to aid in the reduction of temperature in the diarrhœas of children and in dysentery.

The temperature at the start should

not be below 60° or 70° F. In duodenal jaundice cold irrigation (2 quarts) and the alternate hot and cold douche (2 quarts each) have been beneficial. 4. Renal secretion: in ten minutes irrigation at the higher temperatures, especially 110° or 120° F., stimulates the kidneys to secretion by the heat and by the stimulating effect on the circulation, also by the heated blood flowing through the organs. In twenty minutes irrigation at 110° or 120° F. causes excretion from the kidneys actually through absorption from the intestines.

If it is desired to increase renal secretion without increasing pulse-tension or temperature, one should irrigate at 100° to 104° F., and at 105° to 108° F. if moderate increase is not objectionable. Intestinal absorption from the large intestine occurs in twenty minutes.

Saline irrigation is an excellent remedy in acute uræmic suppression or in cases of renal insufficiency. Cold irrigation practically inhibits intestinal absorption, on account of the effect on the circulation at the end of twenty to twenty-five minutes, and therefore should be absolutely contra-indicated in renal disease, as well as the use of cold enemata. R. C. Kemp (N. Y. Med. Jour., No. 1000, p. 141, '98).

Intestinal antiseptics may also be given by the mouth with advantage. Creasote may be administered in emulsion, in milk, or in wine, in doses of from 1 to 5 minims every three hours, salol in doses of 5 grains, betanaphthol in doses of from 2 $^1/_2$ to 5 grains.

Local or general antisepsis of the gastro-intestinal tract by means of medicaments of the aromatic series (benzonaphthol, naphthol, naphthalin, salol) is in reality impossible. These substances do not necessarily break up in the alimentary canal, but they may accumulate or be eliminated without undergoing any decomposition. Bardet (Bull. et Mem. Soc. de Thérap., Nov. 27, '95).

Salol is of considerable power in intestinal indigestion (pain, flatulence, and diarrhœa): 2-grain doses of salol every hour rapidly relieve the symptoms. Milk diet is the best for those suffering from excessive intestinal putrefaction,—preferably, however, mixed with some carbohydrates and a little meat. Peas and beans, oatmeal, whole wheat, Indian meal, etc., must be excluded. Rice or farina may be allowed if well cooked. Eggs, if soft boiled, are well borne. A pure meat diet often brings relief from the symptoms, if persisted in for a few days. Fats, as a rule, do no harm. Physical overfatigue should be avoided. Herter and Smith (N. Y. Med. Jour., July 13, 20, '95).

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Monnet's saccharin No. 3, a saccharinate of sodium, containing 90 per cent. of pure saccharin, given in doses of from 15 to 30 grains once daily about two hours before the principal meal, must take rank among the best intestinal antiseptics. Descheemaeker (Echo Méd. du Nord, April 10, '98).

The salts of bismuth may also be employed, the subnitrate or the subcarbonate in doses of from 10 to 30 grains; the salicylate or the subgallate in somewhat smaller doses.

Ulcerative colitis cured by means of Carlsbad salts, intestinal antiseptics, and bismuth. Anderson (Med. Review, June 23, '94).

A pill of silver oxide, $^1/_6$ grain, and extract of belladonna, $^1/_4$ grain, after each meal, often acts admirably.

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Use of tannalbin in cases of acute and chronic intestinal catarrh, and also in tubercular diarrhœa strongly advocated.

Tannalbin is a brown, tasteless powder, containing about 50 per cent. of tannic acid. It is insoluble in the mouth and stomach, but on meeting with the alkaline secretions of the intestines it is resolved into its original elements, tannin and albumin.

The dose for children varies from 4 to 8 grains. Vierordt (Deut. med. Woch., No. 25, '96).

Ichthyol strongly recommended in intestinal disorders, particularly those

which accompany affections of the genito-urinary tract in women. The dosage is 4 or 5 grains a day, preferably in keratin-coated pills, which are believed to pass through the stomach undissolved. The medicine is best given some little time after meals. Good results obtained in cases of diarrhœa. The best results were in cases of rebellious constipation. Guintzburg (La Méd. Mod., May 13, '96).

Pill of 1 ½ grains of ichthyol every hour or two recommended in all severe cases of acute intestinal catarrh, also in all cases of chronic catarrh of the rectum and hæmorrhoids in which there is a great tendency to tympanites with foul evacuations. This treatment is very efficacious. Lange (Allg. med. Central-Zeit., No. 3, '97).

Colitis, Mucous.

Synonyms. — Membranous enteritis; mucous colic; tubular diarrhœa.

Symptoms.—There occurs occasionally in hysterical women and neurasthenic and hypochondriacal men a condition characterized by the discharge from the bowel, from time to time, of membranous or tube-like material, in conjunction with abdominal pain that may reach a high grade of intensity. Apart from the paroxysms, the bowels are often constipated; sometimes they are loose; they are rarely regular. The stools usually contain mucus. The matters expelled from the bowels consist principally of mucus, although at times fibrinous and cellular elements have been found. They sometimes resemble and may readily be mistaken for sheets or casts of the bowel. It is believed that they are derived from the large intestine. Sometimes they appear in strings or shreds. They are believed to be the product of an abnormal secretion of the mucous glands of the bowel.

Abdominal pains regarded as the most prominent symptom in membranous colitis. These pains, which often precede the evacuations by some hours, are frequently localized in the left side of the abdomen and follow the course of the descending colon and of the sigmoid flexure. The pains may become generalized or may be most decided near the transverse colon, or, at other times, near the cæcum, generally ceasing after the evacuations, though the abdomen remains very sensitive. Besides these spontaneous pains there is pain upon abdominal palpation in different portions of the large intestine and particularly the region of the sigmoid flexure. In such cases the pain is at its height in the entire left iliac fossa. Touvenaint (Revue Inter. de Méd. et de Chir., July 25, '95).

Membranous enteritis is not inflammation, either acute or chronic. It is a secretory neurosis affecting generally the mucous follicles of the colon and their regulating nerves, but sometimes involving the corresponding elements of the small intestine, bladder, uterus, and vagina. There are correlated sensory, vasomotor, and motor disturbances. It constitutes a comparatively rare local manifestation of a general neurosis, usually hysteria or neurasthenia. Glentworth R. Butler (N. Y. Med. Jour., Dec. 28, '95).

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Case of intestinal calculi in a young woman of 31 years, arthritic and neurotic, who had suffered for six years from digestive disorders in the form of flatulent dyspepsia, with dilatation of the stomach. The symptoms of muco-membranous enteritis intervened, with sharp abdominal pain, tenderness along the course of the colon, and obstinate constipation. After passing a large amount of muco-membranous material over a period of six or seven months the patient began to notice small stones in the passages. Most of these stones were about the size of orange-seeds, the largest as big as a nut, and their discharge lasted two or three weeks. The concretions were of a yellowish-white color, and very friable, some of them presenting conical elevations on their surfaces, others smooth. They were homogeneous on

section, and did not contain any central nucleus. Chemical examination showed the stones to be composed principally of carbonate of lime and phosphates of magnesia, with a small amount of organic matter, iron, and water. Mongour (Comptes-Rendus de la Soc. de Biol., Feb. 28, '96).

Intestinal gravel is always associated with membranous colitis. Dieulafoy (Acad. de Méd., Mar. 9, '97).

Etiology.—The attacks are induced, as a rule, by emotional disturbances and errors in diet, and they recur with varying frequency, lasting from a day or two to a couple of weeks.

Literature of '96-'97-'98.

Membranous enteritis has been found to depend on the presence of larvæ in the intestinal canal. Henschen (Wiener klin. Rund., No. 33, '96).

Membranous colitis considered a symptom of enteroptosis, and is due to functional disturbance of the liver. Hepatoptosis leads to altered vascular tension in the liver, and so to a diminished secretion from mucous membrane of the intestine and precipitation of the mucin by the acids in the intestine. The author is in favor of a meat diet and saline purges. Glénard (Acad. de Méd., Apr. 20, '97).

Membranous colitis is a functional neurosis and is an intestinal manifestation of neurasthenia. The proper treatment is that of nerve-prostration. Mendelson (Med. Record, Jan. 30, '97).

Membranous colitis regarded as an hypersecretion of mucus in women of a neuro-arthritic type who suffer from enteroptosis. The constipation is to be treated by giving copious enemata and castor-oil. Intestinal antiseptics, such as naphthol, resorcin, and salicylate of bismuth, should be given. Mathieu (Semaine Méd., p. 226, '97).

Secretion-neurosis is of neurotic origin and course. Both secretion-neurosis and enteritis may co-exist. Secretion-neurosis of the colon occurs chiefly in neurotic females (80 per cent.). It is closely associated with genital disease and is frequently preceded by constipation. The continuation of the disease is partly due to an irritable, vicious habit of excessive epithelial activity. The disease is characterized by colicky pains, with the evacuation of mucous masses; it is not fatal and is variable and erratic in the number of attacks, with an indefinite prognosis. Chemically the evacuations consist of mucin and an albuminous substance. Microscopically there are seen hyaline bodies, cylindrical epithelium, cholesterin crystals, triple phosphates, round cells, various kinds of micro-organisms, and pigment. Secretion-neurosis of the colon is comparable to the secretion-neurosis of the endometrium (membranous dysmenorrhœa) or bronchial croup and appears to be limited chiefly to the part of the colon supplied by the inferior mesenteric ganglion: *i.e.*, to the fæcal reservoir (the left half of the transverse colon, the descending colon, the sigmoid and the rectum). Bryan Robinson (Mathews's Jour. of Rectal and Gastro-Int. Dis., Jan., '98).

They may be attended with acute outbreaks of hysteria, hypochondriasis, or melancholia.

The nervous complications of muco-membranous enteritis are most varied, among those noted being dyspnœa, pseudo-angina pectoris, generalized trembling during digestion, inaptitude for work, headache, aphasia, temporary amnesia, infantile convulsions, coma, etc. A. Mathieu (Gaz. des Hôp., Oct. 27, '94).

Two cases of membranous colitis observed presenting hysterical—one epileptic and the other choreic—symptoms dependent on the condition of the intestine and disappearing as the state of the latter improved. F. Cantru (La Méd. Mod., Jan. 12, '95).

Prognosis.—The condition is often an obstinate one and extremely unyielding to treatment.

The prognosis of membranous colitis is not generally grave, especially when the attacks are not very intense or when they occur at short intervals. However, the disease constitutes a serious complication, for it contributes greatly to produce cachexia and it is very rebellious

to treatment. Touvenaint (Revue Inter. de Méd. et de Chir., July 25, '95).

Prognosis of membranous colitis not especially favorable, since there is little prospect of ultimate cure unless a radical change can be effected in the circumstances and surroundings of the patient. O. D. Doane (Med. Sentinel, Sept., '95).

Membranous enteritis does not yield to treatment in the majority of cases. It may improve while the patient is under treatment, but it also improves for a time without any treatment at all. It is not a fatal complaint. People may have it for years and pass vast quantities of mucus, and yet look fairly well at the end of that time. It often improves temporarily, and then returns after a short or long interval. In some cases it recurs at regular times and continues to do so every month or so for years. It almost always occurs in dyspeptic and somewhat neurotic patients. It is essentially a disease which is affected by the mental state of the patient. In some cases worry always brings on an attack, while freedom from care is almost essential to its cure. C. P. Crouch (Bristol Medico-Chir. Jour., Mar., '95).

Treatment.—Treatment must be directed to the underlying state, although the condition of the digestive tract must not be ignored. Nervines, tonics, intestinal antiseptics, and supporting measures generally are the agents indicated. Asafœtida, sumbul, valerian, iron, strychnine, hydrogen dioxide, creasote, guaiacol, singly or in varying combination, are sometimes useful. The best results are to be expected from rest and a milk diet, with massage and electricity, and later forced feeding and a gradual return to the ordinary mode of life.

In the treatment of membranous colitis rest in bed is essential, with abdominal friction to soothe the pains, using a soothing liniment or camphorated oil to which laudanum has been added. If the pain is very acute, opiates may be given in small doses, either as a potion or an enema. Letcheff recommended the use of copious irrigations with hot solutions of nitrate of silver in the proportion of 1 to 2000, or even 1 to 1000. Touvenaint (Revue Inter. de Méd. et de Chir., July 25, '95).

Tumors of the Cæcum, the Colon, and the Duodenum.

New growths in the intestinal tract are much more common in the large than in the small division. Of the large intestine the rectum is most frequently attacked; then in the order of frequency the sigmoid flexure, the cæcum, and the remainder of the colon. Of the small intestine the ileum seems to suffer most commonly, the duodenum next in frequency, and the jejunum least. The growth is usually primary; less commonly it arises by extension from contiguous disease. Metastasis to other organs is frequent, and rather the more so from the small than from the large bowel. The involvement of adjacent structures and organs also is common.

Case of colloid cancer of the transverse colon, in which the tumor had infiltrated the neighboring tissues, become attached to the abdominal wall, and formed a large, abscess-like cavity; into this opened the transverse colon, a loop of small intestine, and also the lower end of the stomach. The man died of exhaustion. No operation was performed. Dreschfeld (Brit. Med. Jour., Apr. 30, '92).

Case of a woman from whom two primary cancers the size of a man's fist had been removed from the large intestine by Landau. Their cancerous nature having been ascertained by Virchow, the patient was kept under observation, and at her death, a year after operation, the diagnosis of primary cancer of the large intestine was verified, metastases being found in the peritoneum, retroperitoneal glands, left pleura, and abdominal tissues. The primary tumor had sprung from the endothelium of the lymphatic vessel and connective-tissue cells, thus belonging to the class of endothelial cancer of the serous membranes, very

rare in the peritoneum. Ludwig Pick (La Méd. Mod., Mar. 27, '95).

The most usual variety of neoplasm is carcinoma and especially of the cylinder-cell type; epitheliomata are less common. Sarcomata are rare. The disease occurs a little more commonly in males than in females and rather earlier in life than malignant disease elsewhere, a larger number of cases occurring before the age of 30 than when the disease is situated in other parts of the body. The duration of malignant disease of the bowel averages from six to twenty-four months.

Symptoms.—Among the most conspicuous symptoms of malignant disease of the intestine are anæmia, cachexia, wasting, pain, indications of intestinal obstruction, fever, and the presence usually of a tumor yielding dullness on percussion. When ulceration occurs the stools will contain blood, pus, and perhaps fragments of the new growth. The associating symptoms will necessarily vary somewhat with the situation of the growth.

Methods to be followed in examining intra-abdominal tumors:—

Tumors through which gases may be detected by gurgling indicate either an involvement of the bowel in the tumor or pressure of the growth on the bowel, with adhesions to the same. If this symptom is coupled with a history of a pyloric cancer or a cæcal growth, it is confirmatory in its indications. Some growths have a disposition to change position, but all growths have one or more attachments, and it is safe to infer that this attachment is to the site at which the neoplasm had its beginning, its movements being only around an arc of a circle. Adhesions may prevent a growth from moving, or anchor a tumor in a locality far from its original point of starting, and here the history of the inflammatory attacks and pain aid in the diagnosis. The character of the pain and the amount and area of tenderness are of great assistance. The withdrawal of free fluid from the peritoneum often shows the presence of a tumor before undetected. A. H. Cordier (N. Y. Med. Jour., Oct. 26, '95).

Carcinoma of the duodenum is rare.

Among the records of about 18,000 autopsies at Guy's there are reports of 10 cases of primary malignant growth of the duodenum: 4 carcinomata and 6 sarcomata. Together with collected cases, a total of 22 primary malignant growths are described: 13 carcinomata and 9 sarcomata. Secondary deposits of malignant growths are very rarely observed in the duodenum. Perry and Shaw (Guy's Hosp. Reports, vol. l, p. 171).

It may be situated close to the pylorus or in the region surrounding the entrance of the choledoch- and pancreatic ducts or close to the jejunum, and the symptoms will vary accordingly. In addition to other manifestations there are anorexia, nausea, vomiting, and pain. When a tumor becomes palpable it will be found in the right upper quadrant of the abdomen, and it is, as a rule, fixed, and little, if at all, mobile upon manipulation or with the movements of respiration. Pain, when present, has a corresponding localization, but it is likely to occur at a later period after the ingestion of food than that of malignant disease of the stomach. When the first or pyloric portion of the duodenum is the seat of the new growth the symptoms may simulate those of pyloric obstruction, among the most distinctive of which are dilatation of the stomach, with vomiting periodically of vast amounts of fluid and partly-disintegrated food, some of which may have been ingested days before. If the neoplasm develop close to the point of entrance of the biliary and pancreatic ducts into the duodenum,—*i.e.*, in the ampullar portion,—jaundice will almost certainly be a symptom in consequence of obstruction to the flow of bile. If the

disease be situated beyond this point,—that is, in the jejunal portion,—the vomited material will contain bile and intestinal matters.

Primary cancer of the duodenum has, in the great majority of cases, an annular form, and thus most frequently produces stenosis, the stenotic symptoms varying according to the level at which the growth occurs. Above the ampulla of Vater the neoplasm develops in the first portion of the duodenum and presents a symptomatology almost identical to that of pyloric cancer. In that below the ampulla, besides the symptoms accompanying stenosis of the pylorus, there are signs indicating a reflux of bile and pancreatic juice into the stomach, while in that developing about the ampulla the symptoms approach more or less one or the other of the above forms. When diagnosis is impossible, exploratory laparotomy constitutes the first measure necessary for surgical intervention, which, however, in the greater number of instances, cannot be more than palliative. Pic (Revue de Méd., Jan., '95).

Carcinoma of the cæcum is commonly attended with symptoms resembling those that have been more fully detailed in the consideration of typhlitis: pain in the right iliac fossa, with constipation (perhaps diarrhœa), tympanitis, impaired appetite, coated tongue, bad taste, nausea, and vomiting.

Carcinoma of the cæcum is not rarely a most chronic condition that may exist for years without giving rise to symptoms other than slight constipation and the presence of a tumor. Matlakowski (Deut. Zeit. f. Chir., B. 33, H. 4, 5, '92).

The ileo-cæcal region is a point of predilection for the development of malignant tumors, mostly in the form of carcinoma and local intestinal tuberculosis. The lumen of the gut is diminished and the glands much enlarged.

The onset of malignant disease is very insidious, the symptoms being usually those of typhlitis and coprostasis. As regards treatment, resection and reunion of the divided parts are necessary, but symptoms of acute obstructions are contra-indications. Simple enterostomy is here called for, with resection later on. The extent of the tumor and advanced cachexia are also contra-indications. Körte (Deut. Zeit. f. Chir., B. 40, H. 5, 6, '95).

The tumor that develops, with dullness on percussion, will be found in the right lower quadrant of the abdomen, though capable of a certain range of movement. As obstruction becomes marked, attacks of colic will occur, in consequence of the augmented expulsive efforts of the proximal bowel, which at first undergoes hypertrophy, with subsequent atrophy and atony and dilatation, while the distal intestine becomes collapsed and empty.

The symptoms of carcinoma of the colon differ principally in localization from those attributable to like disease in the cæcum.

Case of primary cancer of the colon reported in which the digestive process continued normal without hæmorrhage. Matiguor (Jour. de Méd. de Bordeaux, Dec. 24, '90).

The greater mobility of the large bowel, however, permits of freer movement on the part of the tumor, with greater displacement and greater variability in situation. The closer the growth to the rectum, the more pronounced the change in the conformation of the stools, which may become characteristically narrow in caliber or band-shaped or ribbon-shaped.

Literature of '96-'97-'98.

Case of a man on whom the author had operated in 1894, resecting six inches of the transverse colon, which was the seat of stenosing adenocarcinoma, which had been present for at least a year. The stenosis had become so great that only a small-sized lead-pencil could be passed through the stricture at the time the specimen was removed. There

was great emaciation and pain. Anastomosis was made with a Murphy button of enormous size, which was passed on the eighteenth day. The man gained thirty pounds in weight in a short time, and has remained in perfect health since. There are no signs of recurrence. A number of nodules in the mesentery had been removed, but there were innumerable small ones which had to be left. Howard Lilienthal (Annals of Surg., May, '96).

Under favorable conditions it may be possible to recognize malignant disease of the sigmoid flexure by means of manual exploration through the rectum or with the aid of the sigmoidoscope.

Diagnosis.—Carcinoma of the duodenum is to be differentiated from carcinoma and ulcer of the stomach, from duodenal ulcer, from gall-stones, and from new growths or enlarged glands compressing the duodenum from without. From the two forms of ulceration named, it differs in the progressiveness of character, the shorter period of duration, the development of cachexia, the greater wasting, the presence of a tumor, a diminution in hydrochloric acid of the gastric juice, or perhaps its absence, and the smaller frequency of hæmatemesis (the blood presenting the characteristic coffee-grounds appearance). The differentiation from malignant disease of the stomach will have to be based upon the situation of the palpable tumor and its degree of mobility, the frequency and the time of vomiting, and the situation and the time of occurrence of the pain. Gall-stones may occasion symptoms closely resembling those of malignant disease of the duodenum, but they are unattended with cachexia, they differ in course and duration, and the tumor to which they give rise differs in its general physical characteristics from that due to malignant disease of the duodenum. The differentiation from new growths or enlarged glands compressing the duodenum from without depend largely upon the recognition of the conditions to which such processes are usually secondary. Such growths and glands are unattended with the pain, digestive derangement and vomiting so common with malignant disease of the duodenum.

Malignant disease of the large intestine is to be distinguished from fæcal accumulation, peritonitic adhesions, and the presence of foreign bodies in the intestine. All of these are unattended with cachexia and wasting. In cases of fæcal accumulation there is a history of long-standing constipation, with the correction of which any tumor that was present disappears. When peritonitic adhesions are present inquiry may elicit the previous existence of peritonitis. Among foreign bodies occasionally found in the bowel are gall-stones, enteroliths, and possibly detached pedunculated polypoid growths.

Enterolith weighing three hundred and seventy-five grains; length, two and one-fourth inches; circumference, one and one-fourth inches; diameter, one inch, removed from ileum by longitudinal incision. Death occurred the following day of pulmonary œdema. Perry (Albany Med. Annals, June 20, '88).

Case of impaction of the rectum with water-melon seeds, one quart of which were removed by injections. Ricketts (Cincinnati Lancet-Clinic, Sept. 22, '88).

Case of large fæcal accumulation occurring in a girl, aged 13 years, observed. A rapidly-growing abdominal tumor was not diminished by purgatives, and, as the patient was sinking, an exploratory laparotomy was done. On opening the abdomen the tumor was found to be a fæcal mass in the cæcum and colon. Nothing further was done, as the bowels began to act, and in six days the tumor had entirely disappeared. Worrall (Med. Rec., June 30, '88).

Case showing the diagnostic association between cancer of the colon and floating

kidney. A cancer in the middle part of the ascending colon gave rise to dull achings and pains, which the patient almost certainly associated—at first—with his kidney; and as the mass developed the bowel became more and more loaded and distended, the lumbar achings increased on account of pressure upon the psoas and the lumbar nerves. This pressure was especially felt by the genito-crural branch, and the patient complained of pain's shooting into the groin and into the region of the cord and testis. Had these symptoms been associated with blood in the urine they might have suggested the presence of a renal calculus, but there was no history of hæmaturia. Edmund Owen (Lancet, Apr. 27, '95).

An inquiry into the history and the progress of the case will soon remove any doubt that may have existed.

Sarcoma of the bowel, likewise, is, in the majority of cases, primary, and it commonly gives rise to metastasis. It extends by contiguity and may thus give rise to the dilatation and rigidity of the wall of the bowel. It also appears at an earlier period in life than malignant disease elsewhere. Constitutional symptoms are likely to develop before local manifestations. The temperature often is elevated. There may be constipation alternating with diarrhœa.

Case of stricture below the ampullæ of Vater caused by a small, round-celled, sarcomatous deposit located in second part of the duodenum. The symptoms were: violent pain over the pyloric region, large and frequent vomitings, acid regurgitations, and pain in the head. The stomach was much dilated, the vomited matter contained much bile, and in the contents of the stomach were always found a notable quantity of hydrochloric acid and bile and non-digested food, especially amylaceous material. Masius (Annales de la Soc. Medico-Chir., June, '91).

Literature of '96-'97-'98.

Case of a woman, aged 32, who came under observation with attacks of painful diarrhœa, and a tumor below and to the left of the umbilicus. Laparotomy was performed, and the tumor was then found to involve the jejunum at one metre's distance from the duodenum. The portion of intestine was resected, but the patient died the next day. The growth was twenty centimetres in length, and had sharp margins. The affected part of the gut was enlarged to the size of the transverse colon, its lumen also being increased in size. The mesenteric glands were enlarged. At the operation no other secondary growths were seen. The growth was a small round-celled sarcoma, starting on the submucosa, and had infiltrated all the coats of the bowel. Mermet (Bull. de la Soc. Anat. de Paris, Nov., '96).

Case of myosarcoma of the small intestine in a man, 30 years of age, presenting the following symptoms: Pain in the left flank, constipation followed by diarrhœa, emaciation, and a smooth-surfaced ovoid tumor in the left side of the abdomen, movable and tender. Operation showed a tumor of the small intestine, which was removed by resection of the bowel. The patient was in good health one year after operation. Babès and Nanu (Berliner klin. Woch., No. 7, '97).

The new growth increases in size rapidly, and it may undergo softening at the centre.

The course of the disease is rather rapid, most cases terminating fatally in the course of nine months.

Of benign growths of the bowel adenomata are the most common. They may be flat or polypoid. They are variable in size, although usually small, soft, and bleeding readily. Sometimes they are firm. Their favorite seat is the rectum. They may, however, be numerous and widely distributed. Of other non-malignant growths found in the large bowel may be mentioned fibromata, lipomata, papillomata, myxomata, angiomata, and myomata.

Remarkable case of tumor of the vermiform appendix, developed in a left inguinal hernial sac containing cæcum. This tumor was of a fatty nature, according to histological examination. In the centre was found the appendicular canal, still permeable; it was, probably, a submucous lipoma. Josserand (Lyon Méd., Jan. 3, '92).

Case of large fibrolipoma of the descending mesocolon observed. Twelve centimetres of the large intestine were resected in removal of the growth. Death followed from shock. Duret (Jour. des Sci. Méd. de Lille, Apr. 8, '92).

Case of lipoma in the descending colon, which had been felt on examination, was finally passed at stool. It was about the size of one's fist, and was attached to the gut by a pedicle; the pedicle was ligated and the tumor removed by a thermocautery, the patient making a perfect recovery. Link (Wiener med. Woch., Mar. 27, '90).

In a man who died at the age of 55 years was found a double row of blackish prominences on the large intestine, containing fæcal matter, solid, but not very hard. They were so many diverticula of the intestinal cavity, some in the mesocolon or the mesorectum, others in the pedicle of the epiploic fimbriæ. The first degree of these small herniæ of the mucous membrane was visibly constituted by the normal prominences of the intestine, the largest attaining the size of an ordinary marble. These diverticula began at the colon and from there extended, augmenting in number and volume, to the rectum. Pilliet (Bull. de la Soc. Anat., No. 6, '94).

These growths often give rise to no symptoms. Sometimes the symptoms are indefinite and equivocal. Among the most common manifestations are hæmorrhage, anæmia, diarrhœa, with mucous and blood in the stools and indications of intestinal obstruction.

Treatment.—The treatment of new growths of the intestine is exclusively surgical. Benign neoplasms may demand no interference, even though they may be multiple. Symptoms of obstruction of the bowel would indicate operative intervention. Malignant growths should be removed, if possible, as soon as recognized, providing all of the disease can be excised without compromising life and if metastasis to other organs have not taken place. With the enterectomy may be conjoined some form of intestinal anastomosis, or it may be necessary to establish an artificial anus. The same procedures may be required also for the amelioration of symptoms and, perhaps, the prolongation of life if a radical operation is no longer practicable.

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INTUBATION OF THE LARYNX.—Few operations in the history of medicine have excited more wide-spread interest than intubation of the larynx. It has fulfilled the expectations of its advocates, and has fairly and surely won its way in favor, until it now outranks the older and time-honored operation of tracheotomy. We are indebted to Dr. Bouchut, of Paris, for the idea of relieving stenosis of the larynx by a tube introduced by way of the mouth, but to the late Dr. Joseph O'Dwyer, of New York City, belongs the imperishable honor of reviving the operation from buried forgetfulness, and by his ingenuity of so modifying the instruments as to make them of practical utility.

The relief of laryngeal stenosis by means of catheters introduced into the trachea through the larynx, the use of the short round tube as used by Bouchut (Fig. 1), and Dr. O'Dwyer's early experiments and the gradual development of the instruments (Figs. 2, 3, 4, 5, 6, and 7), are all a matter of history which has been fully recorded in medical literature.

Intubation of the larynx is a difficult

operation; indeed, by many it is regarded as one of the most difficult in surgery. It certainly requires the maximum amount of manual dexterity if it is to be performed with gentleness and celerity. One cannot become expert without considerable practical experience.

Theoretical knowledge is important, but I would emphasize the necessity of a thorough and careful training by practice upon the cadaver. Unless the operation is quickly and skillfully done, it becomes one of the most repulsive and brutal in surgery. This difficult technique has doubtless had much to do with the opposition it has met in the past.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Gradual development of intubation instruments.

Indications.—In considering the subject of intubation, one of the first questions raised will be as to the diseases or conditions calling for the operation. Are all cases of alarming dyspnœa to be treated by intubation? Most decidedly not. In case of foreign bodies so imbedded in the larynx as to produce difficult respiration the performance of intubation would obviously be a fatal mistake. In cases of pharyngeal abscess located low down, causing more or less difficulty in breathing, or the presence of retro-œsophageal abscess, had better, for obvious reasons, be treated otherwise. In many cases there is marked dyspnœa from great enlargement of the tonsils and uvula, associated with nasal obstruction, with little or no involvement of the larynx. Intubation would be useless and uncalled for in these cases. Œdema of the larynx may give rise to great and even fatal dyspnœa. The majority of such cases, I am convinced, are better treated by tracheotomy. In most of these cases the swelling of the arytenoid cartilages and of the epiglottis is so great that the head of the tube in the larynx is overlapped; hence little relief is experienced. The larynx here requires

rest, which it cannot obtain with a large heavy tube *in situ*.

[No form of acute stenosis of the larynx, when situated in or above the chink of the glottis, ever offers any very serious impediment to passage of a tube of the proper size. The infiltration of the mucous membrane, which is the principal cause of the obstruction in croup, is rarely, if ever, confined to these parts, but extends to the subglottic division of the larynx: and, this being small in the normal condition, any considerable swelling of the tissues reduces the breathing space, in some cases, to a

Fig. 8.—Pin-head respiratory passage due to swelling, as an obstruction to the introduction of a tube.

mere pin-hole. Joseph O'Dwyer, Assoc. Ed., Annual, '92.]

Two cases noted in which it was impossible to introduce the laryngeal tube, owing to smallness of the glottis, due to œdema. Ganghofner (Jahrb. f. Kinderh. u. phys. Erzie., Nov. 30, '89).

Intubation with permanent relief of dyspnœa in case of subglottic œdema, using a No. 6 tube. Chiari (La. Méd. Mod., Nov. 14, '94).

[No. 6 tube, the largest of children's tubes, not safe in adults, even immediately after the age of puberty, without a strong string attached. J. O'Dwyer, Assoc. Ed., Annual, '96.]

Literature of '96-'97-'98.

Intubation is of great service in the slighter forms of laryngeal obstruction due to catarrhal inflammations, but in the severer forms of laryngeal obstruction intubation is only slightly more favorable in its result than tracheotomy. A. Jeffreys Wood (Intercolonial Med. Jour., Nov., '97).

Intubation is indicated in every instance in which dyspnœa is caused by laryngeal obstruction, except when due to lodgment of a foreign body in such a manner that the introduction of a tube is mechanically impossible. Bernard Wolff (Laryngoscope, Nov., '98).

When we are called to a case of suffocation, before hastily resorting to intubation we should make a correct diagnosis and exclude the cases in which this operation is clearly indicated. This matter of differential diagnosis is most important, and a patient's life may depend quite as much upon the diagnostic skill of the physician as upon his ability to do the operation when indicated. The special field and usefulness of intubation is in cases of diphtheritic or membranous obstruction of the larynx; the presence of growths in children, as papilloma; and cicatricial stenosis in the adult.

[In cicatricial stricture of the larynx, after thorough dilatation has been accomplished, intermittent intubation, extending over a considerable period of time, will be required in order to effect a cure. First personal case was of this nature, and required occasional dilatation for three years to accomplish a permanent cure. The intervals between the intubation were at first one week, which was finally extended to two months, the tube being left in position from one to three days on each occasion.

The significance attached to the results obtained in a small number of cases of chronic stenosis of the larynx treated by intubation is very different from that to be derived from an equal number of cases of croup, because in the former there are none of the complications that exist in the latter. It matters not how badly the patients swallow, no pulmonary complications ever occur, or, at

least, ever have occurred in my experience. JOSEPH O'DWYER, Assoc. Ed., Annual, '92.]

Intubation recommended in certain cases of laryngeal stenosis from chronic inflammation or from accidental or surgical conditions. Thomas Annandale (Brit. Med. Jour., Mar. 2, '89).

Intubation in syphilitic stenosis affords, in a large proportion of cases, the simplest and most practical means devised of quickly and efficiently relieving the dyspnœa of acute laryngeal stenosis, and for dilating chronic cicatricial stricture with speed and certainty. Lefferts (Med. Rec., Oct. 4, '90).

Intubation in infant in whom nut-shell had entered larynx. Complete relief. Bonain (Revue Mens. des Mal. de l'Enfance, July, '95).

Case of laryngeal stenosis in which tracheotomy was first performed; stricture then dilated with sounds from below until small tube could be introduced from above. Tracheal wound allowed to close and large tubes introduced into larynx. Cholmeley (Birmingham Med. Rev., May, '95).

[This procedure recommended in former editions of Annual. Very slight enlargement of tracheal wound only necessary. From above, the tube may enter one of the ventricles and create false passage. JOSEPH O'DWYER, Assoc. Ed., Annual, '96.]

All cases of chronic stenosis requiring intubation are divided into two classes: (1) those in which the operation is practiced for the double purpose of relieving existing dyspnœa and at the same time producing gradual dilatation of the stricture; (2) those in which it is resorted to in order to get rid of retained tracheal cannulæ. O'Dwyer (Jour. of Laryng., Oct., '94).

It is unnecessary in this connection to review the literature of intubation in cases of papilloma in children or of cicatricial stenosis in the adult. It is a legitimate and often successful procedure in both conditions.

Intubation in Diphtheria.— In the great majority of cases the operation will be called for to relieve the impending suffocation in diphtheritic or so-called membranous croup.

In cases of diphtheritic or membranous stenosis of the larynx, which conditions I believe to be identical with perhaps a very few exceptions, it often becomes a nice question of judgment as to when we should interfere surgically. Shall we operate early with the first symptoms of laryngeal invasion or wait until it is evident the patient must die unless given relief? I would say that if we operate early we will do so in many, in these days of antitoxin, that would recover without operation; on the other hand, if we operate late, after the patient has become comatose, and unconscious, we will lose cases that would recover otherwise. It does not often happen that the operation is done early, as it is generally performed by the specialist, who is only called in as a last resort. I believe it can be safely said that the operation is more frequently performed too late to give the best chances of recovery than too early. Inasmuch as, properly carried out, the operation in no wise compromises the case or adds to its danger, but gives comfort, relieves suffering, and prevents exhaustion, there seems to be no valid reason why the operation should be postponed after certain well-marked symptoms have occurred.

There are signals of danger and distress which should never be passed unheeded and which, once recognized, render the operation imperative. When the voice becomes toneless, and whispering and the cough suppressed; when, in addition, the dyspnœa becomes urgent, and the loud stridor of croup is heard both during inspiration and expiration; when there is marked recession at the base of the sternum and above the clavicles; and when all these symptoms cannot be re-

lieved by emetics, it is certainly time to operate.

While we are not justified in waiting longer after these symptoms have appeared, it is even better when possible to operate earlier. When the diagnosis of diphtheritic or membranous laryngitis is clear and positive, as indicated by the

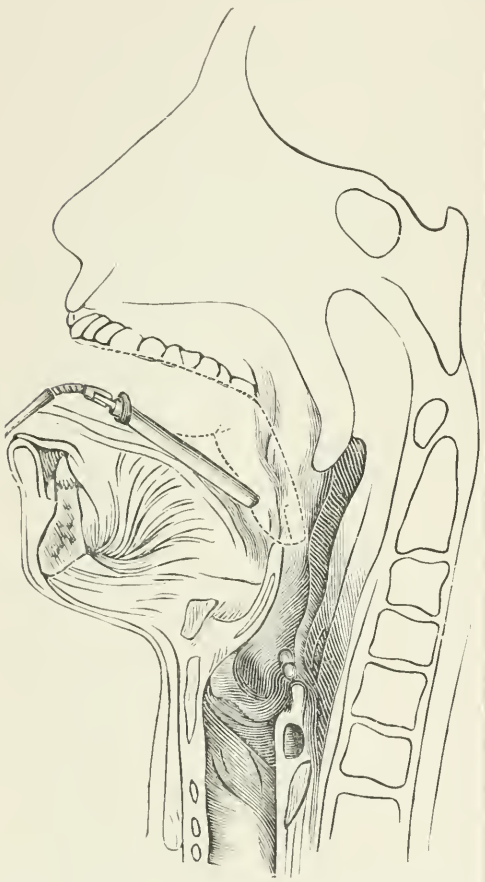

Fig. 9.—Course of the tube from the mouth to the laryngeal cavity.

voice and cough, beginning dyspnœa, the bacteriological examination, and the gradually increasing distress, in spite of treatment, I believe we should not wait until the condition becomes alarming. Again, in infants, and in young and feeble subjects, the dyspnœa, while not sufficient to give rise to marked cyanosis or alarming symptoms of suffocation, may, nevertheless, be sufficient to cause dangerous or even fatal exhaustion. In these cases it is our plain duty to operate earlier than when the patients are older, more rugged, and better able to stand the exhaustion caused by difficult respiration.

In all cases of intended intubation the surgeon should have instruments ready at hand for tracheotomy, and should not only have the consent of the parents for intubation, but for tracheotomy, also, if the latter should become necessary. Bays (Lancet, Sept. 20, '90).

Literature of '96-'97-'98.

Intubation should be practiced in all cases presenting any one of the following symptoms prominently: Deep epigastric recession with each inspiration, labored and prolonged expiration, extreme restlessness, spasmodic attacks coming on at intervals, or persistent cyanosis. In cases seen late it might be wiser to intubate and administer antitoxin rather than administer antitoxin and wait for its effects before intubation. H. M. McClanahan (Brit. Med. Jour., July 9, '98).

The indications of successful introduction of the tube are relief of dyspnœa, and violent, straining cough. It is important that this cough should be present, as it causes expulsion of loose membrane. If it be absent a drink of whisky should be given to excite it. Bernard Wolff (Laryngoscope, Nov., '98).

Technique.—Preliminary Practice.—Preliminary practice upon the adult cadaver is of but little help in acquiring the operative technique for children. The adult larynx, in the cadaver, is almost beyond the reach of the finger; the epiglottis is prominent, while the cavity of the larynx is large and easily determined. In young children, however, the epiglottis is small; while the rima glottidis feels to the touch as a mere slit or depression. By referring to Fig. 9 it will

be seen that if the epiglottis is drawn forward with the finger and the tube is passed in the median line with its point hugging the anterior wall, it must necessarily pass into the larynx. It is important to follow precisely the median line and to hug the anterior wall with the point of the tube.

Many operators prefer to perform the operation in the adult by the aid of the laryngeal mirror. The patient holds the tongue (with a napkin or soft towel between the thumb and forefinger of the right hand) well drawn out, while the operator, sitting in front and aided by reflected light from a mirror on the forehead and by the laryngeal mirror, guides the tube over the epiglottis and engages its point in the cavity of the larynx. Quickly dropping the laryngeal mirror from the left hand he then passes the forefinger down upon the head of the tube and crowds it into position. One accustomed to laryngeal work will perform the operation in this manner very readily, but the procedure is practically impossible for one not familiar with laryngeal instruments and their use.

> [In chronic cases, in which the throat has become more or less accustomed to the use of instruments, intubation can be performed with greater facility and with less discomfort to the patient by the aid of the mirror than by the usual method. Joseph O'Dwyer, Assoc. Ed., Annual, '92.]

Intubation in children by this method is impracticable. The patient must be properly held before a good light. The base of the tongue is held down with a tongue-depressor, and, as the epiglottis rises to view, the point of the tube is directed into the larynx, passing immediately behind the epiglottis. The tube is then pressed down into position with the forefinger of the left hand as the tube is released from its introducer. As soon as the point of the tube passes over the epiglottis, the hand holding the introducer must be quickly elevated, keeping the point of the tube stationary until the turn is made, in order that the tube may pass down at an acute angle. Otherwise the tube will invariably slide over into the œsophagus. The annexed cut shows

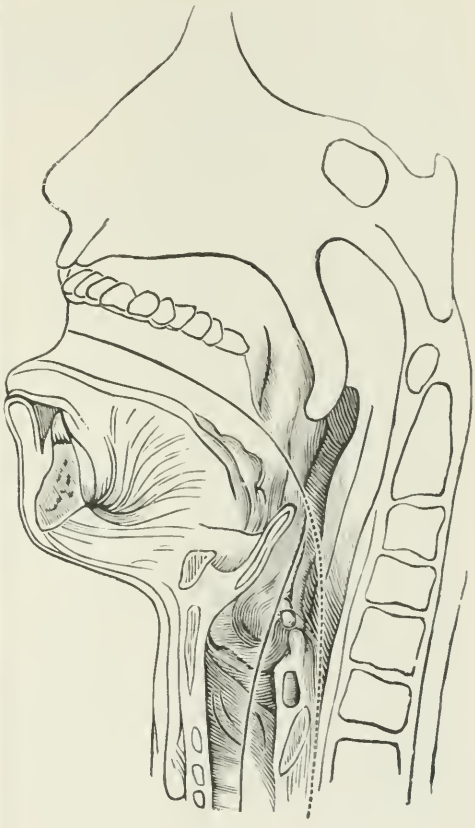

Fig. 10.

how such a misdirection can be given the tube. This method, however, is not to be preferred; but it may be employed by those who do not possess or who cannot acquire the manual dexterity to perform the operation with the assistance of the tactile sense alone, *i.e.*, unaided by the eye.

The ideal operation should be con-

ducted through the sense of touch entirely. One should handle the instruments frequently; the sliding spring of the introducer, shown in the cut, should be moved by the thumb and not by the forefinger. The extractor should be held in the manner indicated by the second figure. By frequently introducing the tube into the closed hand of another person, holding the introducer in the right hand, detaching the tube and pressing it down with the forefinger of the left hand in the exact manner as when introduced into the larynx, slight practical experience can be gained. One should become so familiar with the instruments that the various steps of the operation can be carried out, so to say, automatically.

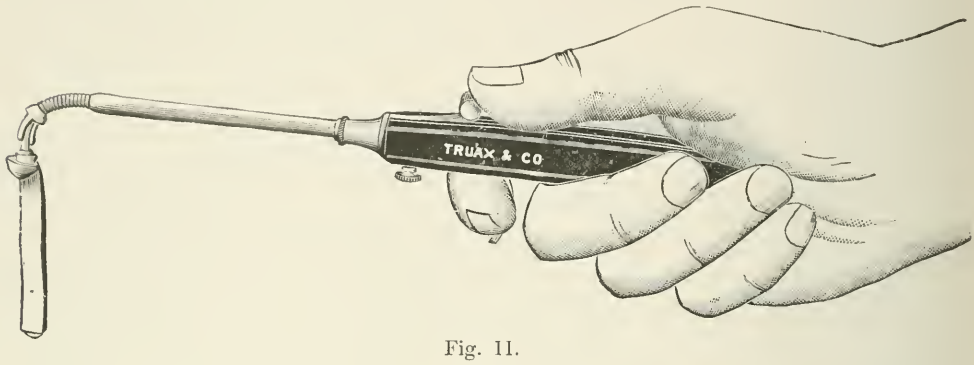

Fig. 11.

As the extraction of the tube is even more difficult than its introduction, it is important also to practice extracting it from the closed hand of another. Introducing and extracting the tube from the larynx of a small dog under an anæsthetic will frequently be of great help in acquiring dexterity.

The instruments should be held lightly. Little or no force should be used, no anæsthetic is necessary, and the operation should not require longer than from five to ten seconds. It occasionally happens that when the end of the tube reaches the larynx, and before it becomes engaged, spasm of the larynx occurs. In such a case it is best, instead of using force, to simply wait a few seconds, holding the tube in position. The patient will then endeavor to breathe, the spasm will relax, and the tube will drop into position.

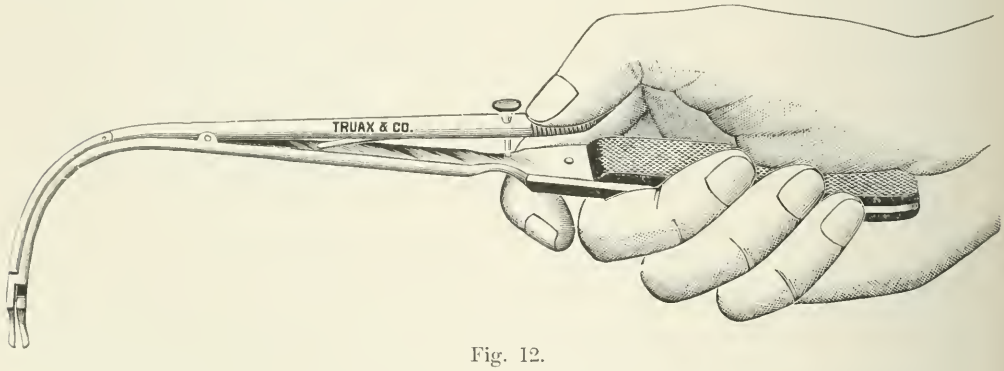

Fig. 12.

In performing the operation the physician should first select a tube appropriate for the age of the patient, as indicated by a scale that accompanies every set of instruments. The tube should then be threaded with silk or linen thread, making a loop about fourteen inches in length. The obturator fitting the tube to be used (Fig. 7) should then be screwed upon the introducer if the O'Dwyer instruments are used, and the tube attached. It is now ready for use, and should be placed upon the table within easy reach. The patient should be held upright in the lap of the nurse supported closely against the left chest with the head resting on the shoulder. The nurse should sit upright in a straight-backed chair and the patient be held firmly and not be allowed to slide down. The forearms of the child should be crossed in front and the nurse should grasp the wrists, the left wrist with the right hand and the right wrist with her left hand. The gag is then introduced in the left angle of the mouth well back between the teeth and widely opened (Fig. 13). The operator standing in front then quickly seizes the introducer with tube attached, hooks the loop or bridle over the little finger of the left hand, and introduces the index finger of the same hand closely followed by the tube (Fig. 14). He raises the epiglottis forward with the index finger (Fig. 9) and guides the end of the tube gently over it when, by making an abrupt turn, he will pass the tube into the larynx if he has been careful to keep in the median line; or he may pass the index finger over the epiglottis and upon the arytenoid cartilages and guide the end of the tube into the larynx.

My method is to feel for the small opening or depression just back of the epiglottis with the finger and guide the end of the tube into it. In any case the end of the tube should pass under the tip of the finger, not over it or by the side of it, but directly under it. The moment the end of the tube engages the larynx the right hand, holding the introducer,

Fig. 13.

should be quickly elevated allowing the tube to pass down at right angle. Simultaneously the tube is loosened from the introducer by pressing forward the slide with the thumb. The index finger of the left hand, which has acted as guide, is placed upon the head of the tube and

gently presses it down into position as the introducer is removed. It is important to bear in mind the necessity of hugging the anterior wall with the end of the tube as it is introduced. In order to do this, it should follow a gentle curve, until it has passed over the epiglottis, and remain stationary for an instant as far as

line, the tube will invariably pass into the œsophagus.

A prolonged attempt at introducing the tube should be avoided. Many brief trials characterized by gentleness will do much less harm. If during the first attempt the tube passes into the œsophagus, the instrument and the finger should

Fig. 14.

downward progress is concerned, while the handle is quickly elevated. The dark line in Fig. 15 represents the curve that should be followed by the end of the tube while it is being introduced. This sudden turn constitutes one of the salient points of the operation, for if the curve be continued as indicated by the dotted

be removed from the throat, and the patient be allowed to recover his breath for a moment. A new trial is then made. Entrance of the tube into the larynx is indicated by violent coughing and by easy respiration, if the tube is not blocked by membrane below it.

To ascertain whether the tube is in

position the child, sitting upright, is allowed to drink a small quantity of water from a glass; if the tube is in the larynx violent coughing will result. If it is in the œsophagus there will be no violent coughing, no relief from the threatening suffocation, and there will also be a gradual shortening of the loop as the tube gravitates toward the stomach.

If the operator is quite certain that the tube has entered the larynx the gag should be removed and the loop placed backward over the ear. While doing this, the hands of the patient should be held firmly by the nurse, otherwise the child will grasp the thread, pull out the tube, and the procedure will have to be renewed. The operator should wait a few minutes to make sure that the tube is in position, and to allow the cough to expel the mucus and softened membrane. He should then replace the gag, cut the loop near the mouth and introduce the index finger of the left hand until it reaches the head of the tube. This is held down while the thread is removed by pulling on one end of the loop.

Literature of '96-'97-'98.

The string should be permitted to remain in place, being passed over the left ear, until quiet breathing is restored, from fifteen minutes to half an hour, and should then be removed by cutting one side of the loop close to the mouth, taking hold of the long end, and withdrawing while the left forefinger is making gentle pressure down on the head of the tube. Never, under any circumstances, should the string be removed without making pressure on the head of the tube, as the string becomes twisted in the mouth and will be caught in the eyelet of the tube and the latter itself withdrawn unless the counter-pressure is made. Another very important precaution is that the person holding the child should never release the child's hands until the string is removed by the surgeon. W. K. Simpson (Med. News, Mar. 19, '98).

If, in introducing the tube, membrane is crowded down ahead of it and respiration is difficult or impossible, as a consequence, the patient should be encouraged to cough violently. As he does this the tube should be quickly jerked by means of the thread still attached. Frequently a large mass of membrane will be expelled. If this does not occur stimulants and water should be given and violent coughing encouraged.

It will occasionally happen that in spite of all efforts a patient is unable to expel the offending and obstructing membrane. In such a case it is necessary

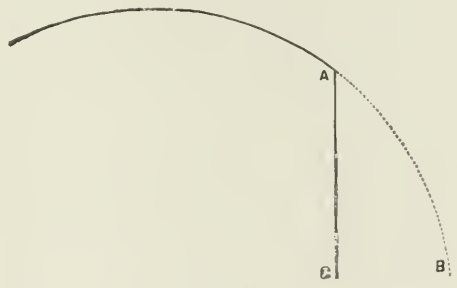

Fig. 15.

to employ a long pair of tracheal forceps and, as the child coughs, endeavor to grasp the membrane and remove it. If still unsuccessful our last resort is to perform tracheotomy and extract the membrane. This, however, is rarely necessary.

Out of two hundred cases in only two has the membrane been crowded down sufficiently to produce asphyxiation, and in both of these it was immediately coughed out on removal of the tube. O'Dwyer (Med. News, June 23, '88).

Pushing down of the pseudomembrane by intubation is seldom observed, and only in rare cases ends fatally. The asphyxia caused by it can be relieved by extubation, and the loosened membrane will be expectorated. If no ex-

pectoration follows extubation, artificial respiration must be performed, and, if this has no effect tracheotomy should be performed. The later obstruction of the tube by pseudomembrane rarely occurs. The thread should be fixed to the child's neck, so that extubation could be performed by the nurse if necessary. Bokay (Pester med.-chir. Presse, No. 12, '94).

Literature of '96-'97-'98-'99.

Of 498 intubation cases, an immediate tracheotomy became necessary in $3\frac{1}{2}$ per cent. on account of detachment of pseudomembrane. Tracheotomy failed to relieve the asphyxia in only 2 of these cases, and these patients died from the pushing down of pseudomembrane. Immediate extubation leads, in most cases, to the result that the loosened pseudomembrane is ejected by violent coughing, either simultaneously with the tube or directly after it. Johann v. Bokay, translated by Edward M. Plummer (Annals of Gyn. and Pediatry, Jan., '99).

After the tube has been successfully introduced the patient experiences entire relief. The change in the appearance of the patient is not only immediate, but remarkable.

The loud stridor, sometimes heard all over the house, the projecting eyeballs, the livid features, the cyanosis, the clutching at the throat, the piteous begging in a whispering voice for help, cease as if by magic. The patient lies pale and quiet. The loud stridor is replaced by almost noiseless respiration, and death is held at bay. The patient falls into quiet refreshing slumber.

After-treatment of Intubated Cases.—Rest and nutrition are now important. In former days the question of feeding was beset with many difficulties, but now happily these obstacles have been largely overcome. It was found by Drs. Frank Carey and William E. Casselberry, of Chicago, while jointly treating a case, that if the patient were placed in the recumbent position, with the head slightly lower than the shoulders, swallowing could be effected with little difficulty. This discovery marked a great advance in the successful management of these cases, and has added not a little to the success of the operation and to the comfort of the little sufferers.

> In order to obviate the difficulties of administering liquids to patients who have undergone intubation, the child should be placed head downward on an inclined plane; an angle of from 45 to 90 degrees seems necessary to obtain the best results. The child is held on its back in the arms of the nurse, the feet elevated, and the head left to hang over the arm, then it may take the mouth of the feeding-bottle, suck through a tube from a glass, or feed from a spoon. The only difficulty is encountered when the child is again placed in the upright position, which posture it must not be permitted to regain until it has been made to swallow three or four times after the vessel of liquid has been taken from its mouth, in order to swallow all the fluid which has gravitated into the pharynx and naso-pharynx. Casselberry (Chicago Med. Jour. and Examiner, Oct., '88).

The mechanism is simple enough: the tube being on an incline, the fluid cannot drop into it. The patient should be placed on a pillow with the head extending slightly over it, either on the back or the side, preferably the side; the pillow is moved over the side of the bed and the head is slightly depressed. If the head is lowered too much the fluid will pass into the post-nasal space and nasal cavities, while if it is raised too much it will pass through the tube and into the lungs and cause violent coughing. A few trials will demonstrate the required position in each individual case. With a little patience and firmness a child should take abundance of liquid nourishment without difficulty. The physician should himself attend person-

ally to this matter until the attendants are so trained that they are fully capable.

Literature of '96-'97-'98.

In feeding children, while the tube is in the larynx, the writer prefers to have the patient lie on the stomach, face down, as this gives greater command over the constrictors. Thomas J. Hillis (N. Y. Med. Jour., Dec. 5, '96).

It is best to give water and food from a spoon, although some children will prefer to draw it through a glass or rubber tube. The nourishment should be milk, beef-juice, or the various soups, although semisolids—as custards, ice-cream, and the like—may be allowed in case there is repugnance for the more fluid foods. Milk is the most convenient, and usually the best food that can be given in these cases.

Regarding the after-treatment, little need be said. Antitoxin should have been given at the very onset of the disease and should have been repeated. If not, it should now be given in large dosage and again repeated in twelve or sixteen hours. If there is a tendency of the membrane to extend downward, indicated by quickened respiration and sometimes by râles or roughened or harsh respiratory sounds, then the antitoxin should be crowded to the limit.

Literature of '96-'97-'98.

Report of twenty-nine cases of intubation with the combined use of antitoxin. All the cases were seen in consultation, and in all of them the operation was urgently required. Three were under two years of age, with two recoveries, or 66 $^{2}/_{3}$ per cent.; eight were two years old, with eight recoveries, or 100 per cent.; six were three years old, with six recoveries, or 100 per cent.; six were four years old, with five recoveries, or 83 $^{1}/_{2}$ per cent.; two were five years old, with two recoveries, or 100 per cent.; and four were six years old, with four recoveries, or 100 per cent. Total, twenty-nine cases with twenty-seven recoveries, or 93.1 per cent., a mortality of only 6.9 per cent. This great reduction in the mortality is attributed to the full and free use of antitoxin in all the cases. Waxham (Archives of Pediatrics, Mar., '98).

If the case is not one of mixed infection all sprays and douches and applications to the throat can be abandoned. In case of mixed infection if there is much offensive discharge from the nose and throat a simple non-irritating antiseptic solution should be gently used in the nasal cavities with the douche or syringe and in the throat by means of the spray; at the same time giving antitoxin and supporting the patient by stimulants and nourishment. How long should the tube be allowed to remain in the larynx? This will depend upon circumstances entirely. If there is a considerable amount of membrane in the trachea it must necessarily come away; sometimes it softens down and is expelled through the tube in the form of muco-pus without difficulty, but not infrequently large flakes or patches become loosened and endanger the life of the patient by obstructing the tube. If a too tightly fitting tube has not been used it will frequently be expelled on the second or third day on account of obstructing membrane below it and commonly it will not be necessary to replace it. It is always to be feared, however, that the tube may not be expelled when it becomes obstructed. Whenever there is evidence of partially detached membrane below the tube, indicated by a flapping sound, a peculiar hoarseness of the cough, or by sudden and evident closure of tube during an expulsive cough we should at once extract the tube whether it has been in one day or three days or four days, or else remain constantly with the patient in order to extract the tube in case total obstruction

occurs and the patient is unable to expel it.

Literature of '96-'97-'98.

In cases where antitoxin has been used it is advisable to extubate after thirty-six or forty-eight hours. This is the time when, by the action of the antitoxin, the membrane is being thrown off.

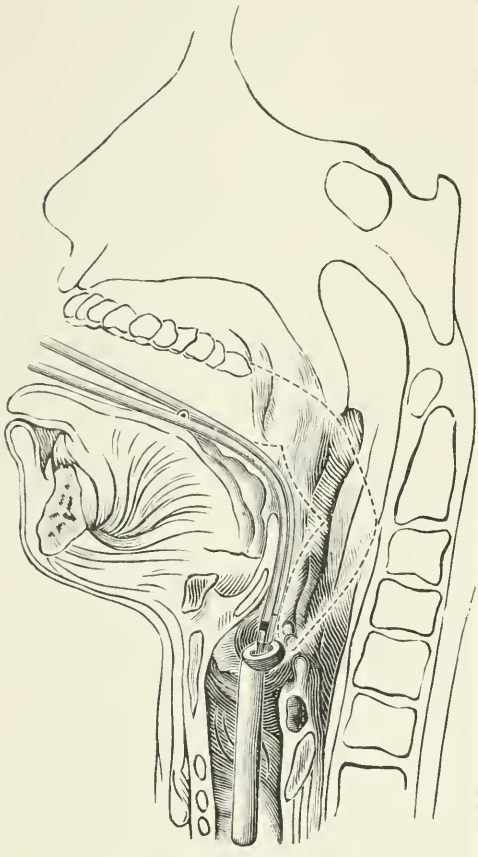

Fig. 16.

It may be necessary to reintubate. J. C. Connell (Brit. Med. Jour., June 5, '97).

The principal indications for removing the tube previous to its final removal are severe discomfort or pain from pressure, especially if the pain be radiating in character, severe attacks of coughing, and sudden stenosis due to the lodgment of membrane in the lumen of the tube. W. K. Simpson (Med. News, Mar. 19, '98).

Obstruction of Tube.—The attendants should be instructed in case of emergency if obstruction occurs suddenly to hold the child with the head down shaking him, while another suddenly and sharply strikes the patient a smart blow upon the chest and back.

Literature of '96-'97-'98.

Syncope caused by intubation of the glottis should be treated by repeated blows upon the back and præcordial region, the child being held with the head downward. Poulet (Bull. Gén. de Thérap., Nov. 8, '96).

In case total obstruction occurs the child will die in a few moments unless the tube can be expelled. Happily these emergencies do not frequently occur. If everything goes smoothly and the patient is taking nourishment well and there has occurred no evidences of obstruction it is my custom to remove the tube on the fourth or fifth day. It will very seldom happen that the tube will be necessary for a longer time, providing the operation has been skillfully performed and no damage has been done to the larynx. The shorter time the tube is worn the less likely are we to meet with paralysis of the vocal cords and other conditions that often require its long continued use.

In extracting the tube the patient should be placed in the same position as when it is introduced. The gag should be placed as before and the index finger of the left hand introduced until it reaches the head of the tube. The extractor, held in the right hand, should quickly follow the finger, the point of which should be guided into the tube. (Fig. 16.) By pressing on the lever above the handle the jaws of the instrument are separated, thus holding the tube securely while it is removed.

Literature of '96-'97-'98.

In a case where attempts at extraction caused a small tube to sink farther down into the larynx, pressure made with the thumb on the trachea, just below the cricoid cartilage, where the end of the tube could be felt, caused cough, which forced the tube out. This method of expression never failed in subsequent cases. The pressure may be made with both thumbs inward and directly upward. If a more powerful pressure is exerted the tube may be forced entirely out of the mouth. Trumpp (Münch. med. Woch., Apr. 28, '96).

While it is the rule that the tube is no longer necessary after the fourth or fifth day and frequently not after the second or third, yet it sometimes occurs that it cannot be dispensed with for two, three, or six weeks, or even longer. After its removal the dyspnœa returns, sometimes immediately, and sometimes after a few hours, occasionally after one or two days have passed.

It is always well to remain with the patient an hour after the removal of the tube or be within ready call in order to replace the tube in case of emergency. Cases of sudden death have occurred from returning dyspnœa after the operation has left the patient in fancied security. As a rule, the dyspnœa returns slowly; so that it is several hours before the patient is in an alarming condition. Occasionally it returns suddenly and almost immediately after the removal of the tube.

Prolonged Use of Tube. — A number of causes have been enumerated as rendering necessary the long-continued use of the tube. Principal among them may be mentioned the formation of diphtheritic exudate or its long persistence in the larynx and trachea; œdema of the tissues; ulceration of the cricoid cartilage and consequent collapse of the thyroid cartilage; cicatricial contractions and exuberant granulations following ulcerations and abduction paralysis.

In some of these the lesions are due to a too tightly fitting tube, to leaving the tube in too long, to poorly-constructed instruments, and some to injuries resulting from unskillful operations.

With the use of antitoxin, which enables the patient to dispense with the tube at an earlier day, and greater skill acquired in performing the operation, these conditions will less frequently arise.

An important point to emphasize is that when the operator appreciates the fact that a tube is too large, as indicated by the force required to press it down into position, he should at once remove it and use a smaller one. The unduly large one will not only cause ulceration or paralysis from undue pressure, but, in case of obstruction below the tube, also give rise to exfoliation of membrane. There will, furthermore, be great danger of sudden suffocation from the inability of the patient to expel the tube.

Erosion of the mucous membrane and exposure of the cartilages observed at the autopsy in 4 of 42 cases. Ganghofner (Jahrb. f. Kinderh. u. phys. Erzie., Nov. 30, '90).

Case in which use of catgut led to fatal asphyxia and to belief that tube had fallen into trachea, the catgut having absorbed moisture and appearing as soft tissue to finger. Delvincourt (Union Méd. du Nord-est, June 30, '95).

[This is sufficient to produce fatal apnœa, a silk thread having produced serious obstruction. In performing tracheotomy after intubation, it is important to remember that, unless the cricoid cartilage be cut, it is impossible to pull tube downward. It must be pushed upward with small forceps or by lateral external pressure. Joseph O'Dwyer, Assoc. Ed., Annual, '96.]

Prolonged intubation and consecutive ulceration of trachea and mediastinal abscess. Meslay (Jour. de Méd. de Bordeaux, July, '95).

Decreasing length of tube a means of obviating obstruction accidents. Bayeux (La Méd. Moderne, May 25, '95).

[Length is as important as breadth, thickness, or calibre. The present length was adopted, not after experiments on cadaver, but on the living, steps being suggested by post-mortem findings. Diphtheria is rarely confined to the larynx when the time for intubation or tracheotomy is reached. Tracheal detached membrane is the greatest danger of intubation: the expiration is suddenly arrested by closure of lower end of tube. Hence the length of the latter. Bayeux's claim for short tubes is theoretical, except in statement that they can be expelled by pressure from outside,—a method frequently employed in the United States. Cheatham claims to have been first in its adoption. JOSEPH O'DWYER, Assoc. Ed., Annual, '96.]

Case of sudden death, on reinsertion of tube, from tracheal cast pushed down by tube, after removal on seventh day. Evans (Archives of Pediatrics, Mar., '95).

[Death, in such cases, may be due to (1) asphyxia; (2) pushing down of membrane; (3) making false passage, beginning in ventricle. The latter is more liable to occur, at the end of the week, on reintroduction, through previous obliteration of the ventricle by pseudomembrane, etc. Practice in cadaver, where the ventricles are avoided with difficulty, is recommended. It can only occur when the patient's head is thrown too far back, bringing the lower end of the tube against the anterior laryngeal wall. JOSEPH O'DWYER, Assoc. Ed., Annual, '96.]

Death a few minutes after intubation in case treated with antitoxin. Supposed to be due to bulbar reflex. Duran (Amer. Jour. Med. Sciences, June, '95).

[Convulsions are usually due to partial asphyxia from prolonged attempts to intubate, and to uræmia. Illustrative case, in which high temperature (107° F.) was found to be cause of convulsions. JOSEPH O'DWYER, Assoc. Ed., Annual, '96.]

Accidental swallowing of tube in 4 cases out of 122. Two of the children passed the tubes,—1 in two days, the other in three days. The other 2 died from disease; one tube found in the stomach, the other in the cæcum. Variot (L'Union Méd., July 13, '95).

[If properly placed and string removed, unusually large percentage of accidents. In only 2 out of almost 500 personal cases were tubes coughed out or swallowed. JOSEPH O'DWYER Assoc. Ed., Annual, '96.]

Literature of '96-'97-'98.

Importance demonstrated on regulating the size of the tube in accordance with the size, and not the age, of the child. Glover (Jour. of L., R., and O., Mar., '98).

O'Dwyer's tube seems occasionally to be productive of laryngeal stenosis. The majority of cases of stenosis occurred in children who had expelled the tube frequently during the treatment of their laryngeal or other trouble. Some of these stenoses were seated below the glottis; others, and they were the gravest, were situated at the level of the cricoid cartilage, where the larynx is narrowest. Repeated expulsions of the tube are symptomatic of laryngeal ulceration of the cricoid region of the larynx. This region should serve as the gauge for the size of the tube to be used which would vary according to the child's age. Bokai, Heubner, Boulay, Sévestre (Twelfth Intern. Congress of Surgery; N. Y. Med. Jour., Oct. 16, '97).

In case there is long-continued necessity for the use of the tube, what can be done? After removing the tube on the fourth or fifth day, if the dyspnœa returns, a smaller tube should be introduced instead of the one removed. This in turn should not remain longer than two days without being removed, providing it has not been previously expelled. If the dyspnœa still returns, introduce a still smaller tube. The effort should now be to use the smallest tube that will be retained. This method, together with the free administration of strychnine, offers the greatest hope of promptly overcoming the difficulty.

Modifications of O'Dwyer's Instruments.—The instruments as fully perfected by Dr. O'Dwyer have been modified by various operators; some of these modifications are questionable improvements, while some undoubtedly possess advantages. The main idea, however, remains unchanged; and, however, greatly the instruments may be altered, the fame of the great and original inventor will never be dimmed. In this connection reference will be made to only a few of these modifications.

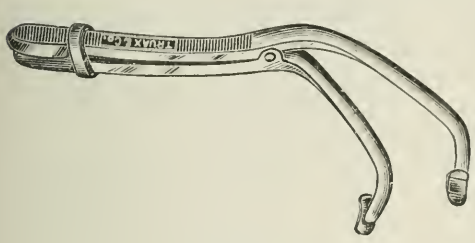

Fig. 17.

The writer, in the early history of the operation finding the original gag (Fig. 17) inconvenient on account of its striking the shoulder, had one constructed (Fig. 18) to extend backward instead of downward, thus overcoming this objection. This gag answers well all requirements. The gag has also been modified by others, notably by Henrotin (Fig. 19) and Allingham (Fig. 20). An ingenious method of overcoming the difficulty of extracting the tube was devised by Dr. Dillon Brown, of New York. It consists of a tube, with small ring attached to the head, and a thimble, with hook attached, which he used on the index finger of the right hand. Having never used this method, I cannot speak of its merits. Another modification has been devised by Ferroud, aiming to make one instrument answer for both extractor and introducer; his instruments have been still further modified and simplified.

Modification of usual instruments so as to make one instrument serve for introduction and extraction of tubes, extractor having much shorter curve. Egidi (Il Policlinico, vol. i, No. 35, '95).

[A single instrument cannot be constructed to satisfactorily serve both purposes. If tubes are long, the curve of the introducer must be short, else the difficulty of entering the larynx is increased; tubes cannot be removed with short-curved extractor except in very young children. Joseph O'Dwyer, Assoc. Ed., Annual, '96.]

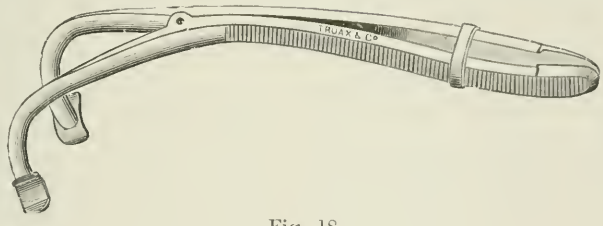

Fig. 18.

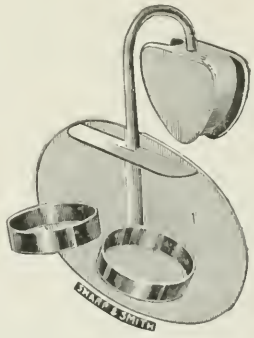

Fig. 19.

The writer some six years ago, with the assistance and co-operation of Charles

Truax & Co., of Chicago, devised a set of instruments differing in many particulars from those of O'Dwyer, the dominant idea, however, being the same. The aim was to insure more perfect disinfection. The obturator has no joint and is not screwed upon the instrument, but is a plain band of steel solidly attached to the introducer. Moreover, the instrument, which consists of only two plain pieces of metal, can be easily separated. There are no crevices in which septic matter can be concealed. The tubes are the same as in the O'Dwyer set. The gag is constructed so as to insure unlocking of the blades for purposes of disinfection. The extractor (Fig. 26) is also so constructed that the three parts of which it is made can easily be separated for the same purpose. These instruments are simple, uncomplicated, and efficient.

Improved intubator for the relief of laryngeal stenosis. The tubes are corrugated and act as a self-retaining device,

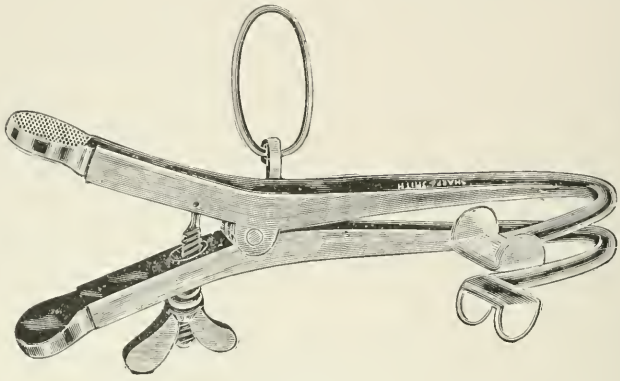

Fig. 20.

being much less easily ejected; they are made of vulcanized Para rubber, the best and purest obtainable. The length is the same as O'Dwyer's. They are made large in the centre. The introducer is so constructed that the lumen of the tube is never occluded. L. Fischer (Med. Record, June 20, '97).

Instrument personally designed combines the offices of extractor and introducer. It has at its distal extremity two serrated beaks about two inches long. They are opened by a pressure with the thumb upon a lever, and are automatically held open by a ratchet arrangement, while pressure with the index finger upon the lower end of this ratchet-bar re-

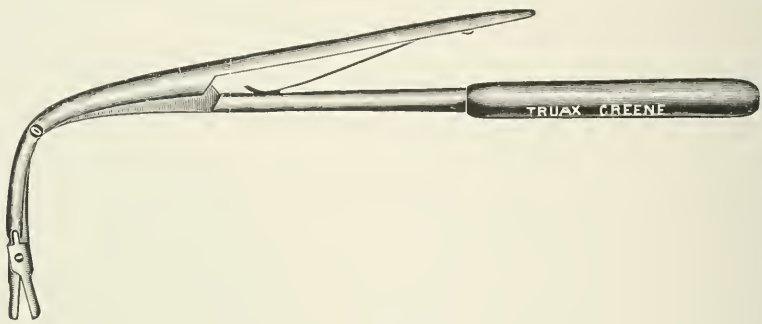

Fig. 21.

lieves it and closes the beaks. By firm pressure the beaks hold the tube immovably. The tubes themselves are also slightly modified, the upper opening being funnel-shaped to facilitate the introduction of the beaks when the tube is in the larynx, and the lower end being cut off at an angle of forty-five degrees, inclining from right to left. This facilitates the passage of the tube between the vocal cords. Max Thorner (Cincinnati Lancet-Clinic, Feb. 19, '98).

ing of the American Medical Association, Section of Pediatrics) in which antitoxin was employed in conjunction with intubation, there were 38 recoveries, or 95 per cent. Such a record I am convinced has never been reached by a single operator with tracheotomy in private practice.

The following tables of my cases well illustrate the success that followed in-

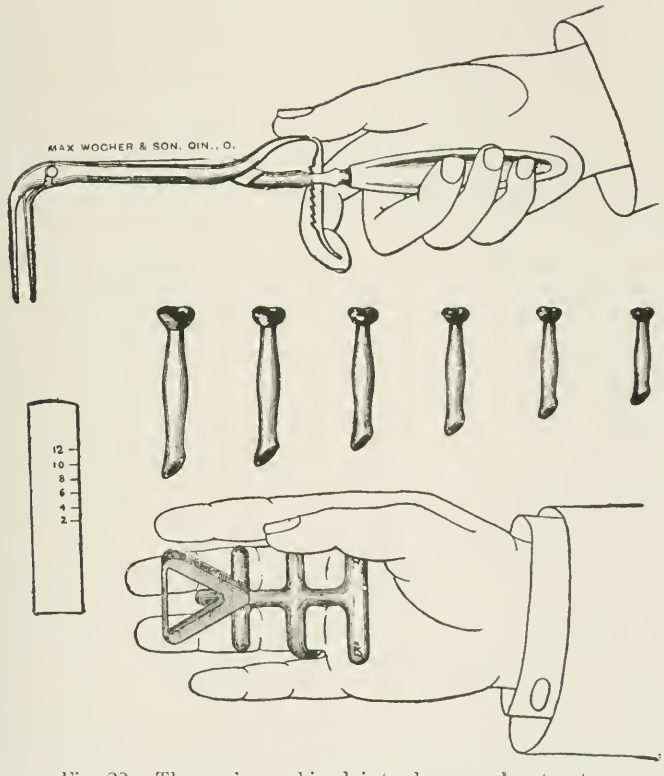

Fig. 22.—Thorner's combined introducer and extractor.

Comparative Value of Intubation.—The weight of evidence, nowadays, as compared to tracheotomy is in favor of intubation as a life-saving operation. Out of 543 cases in which I have performed intubation, all in private practice, I obtained 215 recoveries, or 39.79 per cent. In my last 143 cases, there were 76 recoveries, or 53.14 per cent. In the 40 cases (fully reported at the Denver meeting) increasingly the gradual development of the operation, and the wonderful results of the operation when aided by the use of antitoxin.

First Hundred Cases.

Age.	No. Cases.	Recoveries.	Percentage.
Under 1 year	5	1	20.00
1 year	13	2	15.38

2 years	22	4	18.18
3 years	17	2	17.76
4 years	15	7	46.66
5 years	9	3	33.33
6 years	5	2	40.00
7 years	8	2	25.00
8 years	4	3	75.00
9 years	1	1	100.00
10 years	1	0	00.00
	100	27	27.00

SECOND ONE HUNDRED CASES.

Age.	No. Cases.	Recoveries.	Percentage.
1 year	17	5	29.81
2 years	15	2	13.33
3 years	14	4	28.56
4 years	22	7	31.81
5 years	9	6	66.66
6 years	8	3	37.50
7 years	6	4	66.66
8 years	1	1	100.00
9 years	3	2	66.66
10 years	1	0	00.00
12 years	2	0	00.00
13 years	1	0	00.00
14 years	1	0	00.00
	100	34	34.00

THIRD ONE HUNDRED CASES.

Age.	No. Cases.	Recoveries.	Percentage.
Under 1 year	5	2	40.00
1 year	11	2	18.18
2 years	13	5	38.46
3 years	19	11	57.72
4 years	22	9	40.90
5 years	10	5	50.00
6 years	7	1	14.28
7 years	6	3	50.00
8 years	2	0	00.00
9 years	2	0	00.00
10 years	1	1	100.00
20 years	1	0	00.00
43 years	1	1	100.00
	100	40	40.00

FOURTH ONE HUNDRED CASES.

Age.	No. Cases.	Recoveries.	Percentage.
Under 1 year	2	1	50.00
1 year	11	3	27.27
2 years	20	7	35.00
3 years	19	10	52.63
4 years	20	7	35.00
5 years	11	4	36.36
6 years	5	1	20.00
7 years	5	1	20.00
8 years	3	2	66.66
10 years	2	1	50.00
11 years	1	1	100.00
60 years	1	0	00.00
	100	38	38.00

THE LAST ONE HUNDRED AND FORTY-THREE CASES.

Age.	No. Cases.	Recoveries.	Percentage.
Under 1 year	2	0	00.00
1 year	19	7	36.84
2 years	28	22	78.57
3 years	35	17	48.57
4 years	20	11	55.00
5 years	9	4	44.44
6 years	9	8	88.88
7 years	8	2	25.00
8 years	5	4	80.00
9 years	1	0	00.00
10 years	2	1	50.00
12 years	2	0	00.00
13 years	1	0	00.00
17 years	1	0	00.00
36 years	1	0	00.00
	143	76	53.14

THE LAST FORTY CASES.

Age.	No. Cases.	Recoveries.	Percentage.
1 year	5	4	80.00
2 years	12	12	100.00
3 years	6	6	100.00
4 years	6	5	83.33
5 years	2	2	100.00
6 years	7	7	100.00
7 years	1	1	100.00
8 years	1	1	100.00
	40	38	95.00

An agent which would arrest the progressive descent of the diphtheritic process from the larynx into the bronchi and hasten the disappearance of the obstructive exudate is just what was needed to make intubation the ideal operation for the relief of the great majority of cases of croup requiring operative interference. Such an agent we now possess in antitoxin for a large group of cases, and we are not surprised, therefore, to find that the employment of intubation as a substitute for tracheotomy, has been considerably extended by the introduction of serum-therapy. W. H. Welch (Trans. Assoc. of Amer. Phys., vol. x, '95).

Two thousand three hundred and sixty-eight cases of intubation collected from the reports of 166 operators, with 647, or 27 3/10 per cent., recoveries. Dillon Brown (N. Y. Med. Jour., Mar. 9, '89).

Two thousand four hundred and seventeen tracheotomies performed for croup, with 586 recoveries, or 24.2 per cent., and 5546 intubations, with 1691 recoveries, or 30.5 per cent. George McNaughton and William Maddern (Brooklyn Med. Jour., Aug., '93).

Collective investigation on intubation in Germany, gives an aggregate of 1445 cases intubated for the relief of croup, with 553 recoveries, or 38 per cent. Ranke (Münch. med. Woch., No. 44, '93).

The results in tracheotomy are: in 15,995 cases, 4816 recoveries, or 30.18 per cent.; in intubation, 8299 cases, with 2486 recoveries, or 29.97 per cent. In 769 cases of intubation secondary tracheotomy has been practiced 136 times as a last resource, and has given ten cures. Gillet (Gaz. des Hôp., Mar. 5, '94).

Literature of '96-'97-'98.

Twenty-six cases of intubation for croup in a country practice, with a mortality of 30 per cent. Abarnou (Thèse de Paris; Pediatrics, May 15, '98).

I fully believe that when antitoxin is given early and properly and energetically employed in full doses and repeated that the disease is at once cut short and that no further progress occurs. Again, I am fully convinced that if a patient dies after intubation from bronchial obstruction due to the presence of diphtheritic exudation, that the remedy has either been used late, the extension having taken place before its administration, or that it has been used with a hesitating hand and in insufficient dosage or that the preparation has been of uncertain strength. The normal prognosis in diphtheritic or membranous croup, is so fatal that hesitation in the use of antitoxin is almost criminal. A full dose of 2000 units should be given to a child and half the strength for infants, repeating or even doubling the dose in twelve or sixteen hours. It should be given in full doses and be repeated once, twice, or thrice, if necessary.

O'Dwyer has stated that acute nontraumatic stenosis of the larynx in children that endangers life by suffocation is, with rare exceptions, diphtheria. This disease, if unrelieved by mechanical means, proves fatal in about 90 per cent. of the cases, and, with all the aid that medicine and surgery can afford, it still continues to be, with few exceptions, the most fatal of all acute diseases. In contrast to this statement it may now be said that as a result of the early and free use of antitoxin, aided by properly per-

formed intubation, death from this disease should rarely occur.

F. E. Waxham,
Chicago.

INTUSSUSCEPTION. See Obstruction, Intestinal.

IODINE, IODOFORM, AND OTHER DERIVATIVES.—Iodine, obtained from the ashes of sea-weeds and from crude Chilean saltpeter, occurs in the form of bluish-black scales. It gives off a characteristic violet vapor and emits an acrid and unpleasant odor when burned. Iodine was discovered by Courtois in 1812 in sea-salt. It is not found in its pure state in Nature, being combined with potassium or sodium in marine plants, which absorb it from their surroundings. Iodine melts at 107° C., but volatilizes completely at 175° C. It gives off fumes at ordinary temperature. It is but slightly soluble in water (1 part in about 7000), but is very soluble in alcohol and glycerin.

Iodine imparts a dark-yellow or brown color to all substances over which it is lightly applied, but wherever starch is present the coloring is blue. This property to color starch blue is so marked that it serves as the basis of various tests that make it possible to detect iodine in about four hundred and fifty thousand times its weight of water. Its detection in urine is greatly facilitated by allowing a portion of the liquid to evaporate; the addition of a few drops of nitric acid serves to insure the liberation of any iodine that may be present in combination with other elements.

In estimating the iodides in the urine, the decomposition of these salts by chlorine may be employed. Two and one-half drachms of urine are taken, and an equal quantity of hydrochloric acid and 2 or 3 drops of chlorine-water added. A brown color appears, which is changed to blue by the addition of starch-water. For quantitative estimation the urine is evaporated and charred and the char burned off. The residue is taken up with water acidulated with nitric acid, and nitrate of silver added to excess. The precipitate consists of the chloride and iodide of silver. It is collected, dried, and weighed, and then subjected to chloridization, as above. The difference in weight, due to the transformation of the iodide into the chloride, is the basis for calculation of the quantity of iodine in the primary precipitate. Jolles (Zeit. f. anal. Chemie, B. 30, p. 288, '91).

Attention called to a source of failure in recognizing the presence of iodine in an ammoniacal urine, which must be of considerable importance. When one adds strong, fuming nitric acid to the urine containing an iodide the iodine is freed, and is usually recognized by solution with a purplish color in chloroform. If, however, the urine contains ammoniacal compounds this reaction may be quite different. The iodine reacts upon the ammonia salts, and is formed into nitric iodide and hydriodic acid ($NH_3 + 6I = NI_3 + 3HI$). This substance is very unstable, and in decomposing forms iodic acid, hydriodic acid, and nitrogen ($4NI_3 + 3H_2O = 6HI + 3I_2O + 4N$). Thus, one may entirely fail to get the characteristic chloroform solution. To such a urine caustic potash should be added to replace the ammonia, in order that this mistake be avoided. Gillet (Annales de la Polyclinique, Oct., '91).

Literature of '96-'97-'98.

Attention again called to the use of iodine as a test for bile. The reagent is a dilute tincture of iodine, of a bright mahogany color. The test is made by allowing the iodine to run into an inclined test-tube containing the suspected fluid, and in the presence of bile forms a grass-green ring at the point of contact. Rosin (Wiener klin. Woch., No. 11, '98).

Preparations and Doses.—Iodine is not employed in solid form. The prepara-

tions generally utilized are the following:—

Tincture of iodine is a 7-per-cent. solution in alcohol. It is not used internally because the iodine is precipitated by the gastric juices. It should, therefore, only be employed for topical applications. A decolorized tincture has been made and used, but it contains no iodine, and is worthless.

Compound solution of iodine (Lugol's solution). This is, by far, the best preparation of iodine for internal use. It contains 5 per cent. of iodine and 10 per cent. of iodide of potassium. Dose, 3 to 15 drops, largely diluted.

Ointment of iodine contains 4 per cent. of iodine, 1 per cent. of iodide of potassium, 2 per cent. of water, and 93 per cent. of benzoated lard.

Potassium iodide, white colorless crystals, slightly bitter saline taste, soluble in water and alcohol. Dose, 5 to 30 grains, but well diluted.

> Potassium iodide is better borne if it is given immediately before eating, but it may be administered during or after a meal to avoid its coming in contact with the mucous membrane of the stomach and so being absorbed too rapidly. Editorial (N. Y. Med. Jour., Sept. 1, '94).

Potassium iodide should *not* be administered soon after a meal, since the iodine will form the inert iodide of starch.

Sodium iodide; same properties as the iodide.

> Iodide of sodium preferred to that of potassium on the ground that it is less apt to produce nausea, loss of appetite, and emaciation. It also contains more iodine in the proportion of 10 to 9. R. Cory (Brit. Med. Jour., May 26, '88).

The only substitute for iodide of potassium which has given satisfaction is the iodide of rubidium. While possessing the same advantages as the iodide, it is not as unpleasant to the taste and is better tolerated. The dose and its indications in therapeutics are the same.

> The new product—iodide of rubidium—is better tolerated than iodide of potassium. Neisser (Ther. Monats., No. 5, '94).
>
> Iodide of rubidium preferred in syphilis. Leistikoff (Monats. f. prak. Derm., No. 10, '93).
>
> Iodide of rubidium was well borne by three patients who could not tolerate iodide of potassium. It is applicable in cases where a prolonged treatment with iodine in small doses could not be instituted on account of the individual susceptibility of the patient. Vogt (Revue Gén. de Clin. et de Thér. Jour. des Pract., May 19, '94).

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> Series of experiments demonstrating the great value of iodide of rubidium as a substitute for the iodide of potassium or sodium. In syphilis it restores hæmoglobin, increases the number of blood-corpuscles, and increases the body-weight. Colombini and Pasquini (Jour. des Prat., Oct. 15, '98).

Solution of arsenic and mercuric iodide (Donovan's solution) contains 1 per cent. each of the arsenic iodide and the mercuric iodide. Dose, 1 to 8 drops, well diluted.

Ammonium iodide; colorless plates, having a bitter taste. Similar to iodide of potassium. Dose, 3 to 5 grains, well diluted.

Strontium iodide; colorless plates; bitter saline taste; become yellow on exposure to the air. Soluble in hot and cold water. Similar to the iodide, but thought to be less irritating to the intestinal tract. Dose, 5 to 10 grains well diluted.

Physiological Action.—When applied to the skin, iodine turns it a yellowish brown. At first it acts as a slight irritant, but when the applications are too frequently repeated, or the preparation

is too concentrated, the superficial structures may undergo a process of active inflammation, which usually subsides, however, when the applications are stopped.

When taken internally, iodine, as well as its salts, is eliminated by the kidneys, and tends to irritate these organs when large doses are administered. At first the flow of urine is increased; later on it is decreased, and the proportion of urea may also be greatly diminished. It frequently causes albuminuria, and nephritis has been ascribed to the influence of the iodides, but the evidence that nephritis was not already present before the administration of the remedy has not been made clear in the cases reported. Notwithstanding Haig's view to the contrary, increase of the products of metabolism, urea, etc., in the urine, has been noted by many observers, and it is probable that contracted kidney, a condition now known to be present in most cases, in part accounts for Dr. Haig's views. Sée and other observers have claimed that iodine accumulates in the system, and that its elimination occurred irregularly. Küss ascribes to this fact the majority of the deleterious symptoms often attending its use.

> Urine of patients of both sexes and all ages analyzed. The amount of iodide of potassium eliminated in the urine was increased in proportion to the dose administered. Observation demonstrated the fact that symptoms of iodism, when they appeared, were caused by the retention of iodide of potassium in the system. They occurred when only half the amount given had been eliminated. In cases where doses of 20 grains are administered iodide of potassium is eliminated in the proportion of 75 per cent. There is no danger to the system, provided the excretive power be, to some extent, normal. Doses containing more than 20 grains seem to be incompletely absorbed. Ehlers (London Medical Rec., Sept., '89).

> Arterial tension varies with the uric acid that is circulating in the blood. Some twenty drugs, or rather groups of drugs, all diminish the excretion of the uric acid in the urine, and at the same time produce also relaxed arterioles, lowered arterial tension, and diuresis. Iodides can be classed with these drugs. This action of iodides on the solubility of the urates, and so on the contraction of the arterioles, enables us to explain all their most important effects in physiology and pathology. A. Haig (Brit. Med. Jour., Jan. 14, '93).

> Case in which a man with traumatic periostitis of the tibia was given iodide of potash. In addition to the usual symptoms of iodine poisoning there was a large albuminuria, with fatty and granular casts. No iodine was found in the urine, which had a specific gravity of 1026 and a dark color. Gerson (Münch. med. Woch., June 1, '89).

Iodine, according to Küss, accelerates the cardiac action in persons in whom the circulation is quiet. Haig, as shown, connects the arterial tension with the amount of uric acid circulating in the blood. The majority of authors recognize the existence of dilatation of the capillaries and smaller blood-vessels, but the reports upon this point are exceedingly contradictory. A general retrospect of the views advanced would tend to show that the quantity administered has much to do with the problem, large doses tending to increase arterial pressure.

> Iodized water and solutions of iodine or iodides do not affect the blood-pressure when injected into the veins. Solutions of iodide of potassium, introduced in the same manner, act like potassium and increase it. In larger doses they provoke a fall in blood-pressure. Iodide of sodium proves less dangerous in this respect, and in large doses produces a temporary increase of pressure, followed by a period of gradual diminution. The effects of the iodides in the treatment of arteriosclerosis may possibly be explained by their beneficial influence on

general nutrition. Prevost and Binet (London Med. Recorder, Sept., '90).

Study of the effects of iodide of potassium upon the blood of fifteen patients and four healthy persons before and after taking iodide of potassium. The effect of the medicament in doses of from 15 to 30 grains a day on non-syphilitic patients and on healthy persons is, during the first two or three days of its administration, to increase the number of young corpuscles and to diminish the number of overmature white corpuscles in the blood, and, at the same time, to increase the number of those breaking up. As to the total number of corpuscles per cubic millimetre, the effect of the iodide appears to be to cause an increase, but a slight one. Administered to syphilitic patients, the iodide produces an increase in the number of overmature elements and a decrease of the immature white corpuscles and those which are breaking up. T. V. Ishumin (Inaug. Dissert., No. 120, '94).

Iodide of potassium dilates the vessels somewhat more than does digitaline, and increases considerably the peripheral circulation, as well as the circulation of the arteries which supply nourishment to the heart. G. Sée (La Méd. Moderne, July 2, '91).

Literature of '96-'97-'98.

The iodides given in relatively small doses, three or four times daily, and continued for many months and even years, have the power to retard, modify, and improve subacute and chronic inflammatory processes in connective tissue of parenchymatous organs like the kidneys, the liver, the lungs, and particularly so the sclerotic disease of the arterial vessels. It appears that this salutary effect is brought about by direct inhibition of the proliferation of the connective tissue, as well as by subsequent induction of disintegration and fatty metamorphosis of infiltrated corpuscular elements and the removal of the same. It is reasonable to hold that the drug manifests and develops its activity through the lymph-channels and spaces of the affected organs by direct action upon the irritating substances, by stimulating the vasomotor nerves and increasing the functional activity of the parts. The favorable influence of the iodides can be clinically demonstrated, and is more decided in arterial sclerosis than in similar disease of parenchymatous organs, and will show itself frequently, whether the underlying cause is gout, alcoholism, or syphilis. Leonard Weber (The Post-graduate, Oct., '98).

Iodism. — Coryza and profuse discharge from the mucous membrane of the upper respiratory tract, ptyalism, and an acneiform eruption generally starting over the shoulder-blades constitute, in the majority of cases, the initiatory symptoms, indicating iodism. This may appear after a few doses have been taken in persons who possess a distinct susceptibility to the drug, but in the majority it is not until the dose administered has become quite great. In some persons small doses are more likely to cause iodism than large ones. In some patients the active manifestations are much more grave, nausea, diarrhœa, and marked frontal headache being complained of. The skin-eruption may assume many phases, from a simple acne or dermatitis to eruptions simulating those of variola, varioloid, purpura, eczema, etc.

In order that iodism can arise, (1) nitrites must circulate in the blood; (2) the reaction on the mucous membranes must not be alkaline. On this hypothesis there are three indications for treatment: 1. To attempt to combine the free iodine again. 2. To remove the nitrous acid at the moment of its liberation from the nitrites. 3. To prevent the formation of free nitrous acid. 4. No way of accomplishing this purpose is found. 5. Nitrous acid is destroyed by sulphanilic acid, with the formation of diazo-benzol-sulpho-nitrate, as asserted by Ehrlich. The writer tried $1\frac{1}{2}$ drachms of sulphanilic acid and $\frac{3}{4}$ to 1 drachm of sodium carbonate in 5 fluid-ounces, immediately after the appearance of iodism, and obtained the happiest

results in a number of cases, thus supporting Ehrlich's views. Two and one-half to 3 drachms of sodium bicarbonate are given within twenty-four hours in two doses. It was found that when potassium iodide and bicarbonate of soda were given simultaneously, no symptoms of iodism appeared, but iodism promptly manifested itself on the withdrawal of the bicarbonate of soda. Rohmann and Malachowski (Ther. Monats., July, '89).

Case of a man who took 16 grains of potassium iodide per diem for sixteen days. Copious watery diarrhœa set in as soon as the drug was commenced, though the patient suffered previously from habitual slight constipation, and the diarrhœa persisted during the administration of the drug, ceasing only when it was discontinued. The patient was much reduced in weight, but quickly gained flesh when the iodide was stopped. The drug used was pure, containing no free iodine or iodates. D. W. Montgomery (Med. News, Dec. 29, '94).

In acute iodism in syphilis the headache may reach an alarming intensity; vomiting, vertigo, symptoms of cerebral compression, delirium, staggering gait, somnolence, and coma may supervene. One case showed alarming depression of the heart's action. Neuralgias of the cerebral nerves often occur. These symptoms are probably due to an increased cerebral circulation in vessels which have undergone specific alterations. The best method of obviating unpleasant effects is to give the iodide in milk; belladonna may be added, as well as potassium bromide. E. Finger (Gazeta Lekarska, No. 24, '91).

Literature of '96-'97-'98.

Case of an old syphilitic who was absolutely intolerant of the potassium salt, even when given in small doses. When 90 grains of sodium chlorate were given each day it was possible to administer 45 grains of potassium iodide without any untoward symptoms. This was continued for about forty days. Calomenopoulo (Jour. des Prat., No. 18, p. 288, '96).

When any of the preparations of iodine are used internally, the respiratory tract should be watched lest dyspnœa occur from œdema of the glottis. This is especially the case when syphilis is present. The likelihood of this untoward feature is decreased by the copious use of drinking-water while the iodides are being taken.

Series of nine cases collected from the literature which show that in rare cases the internal use of iodide of potassium may suddenly produce such intense œdema of the glottis as to render necessary the immediate performance of tracheotomy. In some cases the œdema is so severe as to produce death, although in others it may disappear as rapidly as it occurs. It was shown that the untoward consequence may occur soon after the injection of the drug, and even after small doses. Four cases presented the œdema on the first day, 1 under a dose of 15 grains, 2 under 7 ½ grains, and the fourth under as small a dose as 3 grains. Three cases showed the symptoms on the second and the eighth on the sixth day, after doses varying from 30 to 195 grains. It was observed, where œdema occurred, that all other symptoms of iodism were absent, and, further, that age and sex had no influence; that it appeared in otherwise perfectly healthy persons, and that after the disappearance of the œdema persistence in the use of the drug produced no unfavorable after-effects; so that iodism is not a permanent symptom. Œdema of the glottis, fatal in a few minutes if not relieved promptly, may supervene on the early administration of the drug, and that the longer the salt is used, the less danger is there of œdema. A. Groenouw (Ther. Monats., Mar., '90).

Case in which, some days after the omission of the iodide of potassium, which had been given for the treatment of syphilis, there occurred laryngeal œdema with stridor. Eight days later the affection disappeared. P. Heymann (Jour. of Laryngology, Feb., '92).

Atrophy of the mammæ and testicles has been observed when iodine or its

salts had been administered for a long time. Mental disorders, insomnia, hypochondriasis, and hysteria have also been noted. Peripheral nervous disorders—such as neuralgia, neuritis, etc.—have occasionally been produced. The neuralgia is sufficiently severe at times to necessitate the discontinuance of the remedy. Küss states that the menstrual flow may assume an hæmorrhagic form. Rapid emaciation sometimes results from the continued use of iodine or its preparations.

Two unusual cases of chronic iodism. One patient was an hysterical girl, aged 16, whose iodism was believed to result from prolonged and incessant inhalation of sea-air. The other patient was also a woman, aged 55, one of a family of insane persons. In her case the iodism resulted from the inunction of an ointment of iodide of potash. In both cases there was emaciation and prostration, succeeded, in the second case, by fixed delusions and "melancholic mania." V. Gauthier (Brit. Med. Jour., Mar. 23, '89).

Iodism is less likely to occur in children than in adults. The chances of iodism are decreased when the patient is careful to greatly dilute the salt taken.

Attention drawn to the fact that iodism is of exceptional occurrence in children, and, the younger the patient, the less is the liability to this accident. J. Comby (La Méd. Mod., July 10, '95).

The absorptive power of potassium iodide and sodium salicylate diminishes as the age of the patient advances, and this is probably due to the different condition of the vascular system existing at different ages. K. L. Jatzüta (Inaug. Dissert., No. 12, '90).

Prevention of Iodism.—Probably the best remedy we have is Fowler's solution; it in no way seems to interfere with the action of the iodine preparations. From 2 to 4 drops given during meals in water, the iodides being administered after meals in considerable water, most satisfactorily serves the purpose. The carbonate of ammonia, the bromides, and belladonna have been extolled by some writers, but these agents are liable to give rise to unpleasant symptoms when administered during a prolonged period. The bromides are especially objectionable.

The remedy need not be discontinued when iodism is produced, in the majority of cases. By reducing the dose the untoward effects may be sufficiently mitigated. When the iodides are completely withdrawn, they sometimes cause a renewal of the iodism even more severe than the first attack.

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In the treatment of iodism the use of extract of belladonna, 1 to 2 grains, daily recommended in order to avoid the naso-pharyngeal symptoms. Sodium bicarbonate in dose from 90 to 180 grains seems to benefit the general manifestations of the poisoning. Sulphanilic acid in from 40 to 60 grains per diem will fix the nitrous acid, which, remaining in a free state, would decompose the iodide. In addition, a diet poor in nitrates—as milk, bread, and meats—should be insisted upon. For the eruptions, antisepsis of the skin is important; baths and lotions of lime permanganate (1 to 25,000) are useful. The best method, however, is the preventive. One should always commence with a small dose (7 grains), and gradually increase the amount. Large quantities of milk and even diuretics are prescribed with the drug. Hæmorrhage should be treated by ergotine, salivation by potassium chlorate. Œdema of the glottis may necessitate tracheotomy. Briquet (La Sem. Méd., No. 18, p. 137, '96).

Iodism is due wholly to the elimination of iodine by the various mucosæ of the body. The decomposition of the iodine salts which precedes this elimination is due to the presence of nitrites in the blood. By using naphthionic acid this decomposition is prevented. Capitain (La Méd. Mod., June 4, '98).

Poisoning by Iodine.—A small dose of iodine produces no uneasiness apart from a metallic taste which is sometimes persistent. When large doses are taken, the symptoms of iodism appear; and a marked sensation of burning may be experienced in the gastric region and along the œsophagus. Great thirst is complained of. There is increased sexual excitement. Nausea, vomiting, cramps, and purging may be induced. There may be tinnitus, shooting pains, and increased flow of urine. When a poisonous dose is taken, these symptoms are aggravated; there is great pallor and later on cyanosis, anuria, and the pulse is thready, and there is marked prostration. The vomited matter is tinged yellow and the urine, if any can be obtained, dark brown: there is increasing nervous excitement, spasm, and finally a comatose state.

The application of iodine over large surfaces has also induced toxic symptoms; its injection into morbid growths likewise.

The quantity of iodine capable of causing toxic symptoms varies greatly. While large doses (2 1/2 drachms) have been taken without producing marked effect, one scruple has induced violent symptoms. Its absorption is extremely rapid; O'Shaughnessy found iodine in the urine four minutes after its injection. The toxic effects are transmissible to a nursing infant.

> Case of a woman, aged 26, who took, with suicidal intent, a half-glass of the tincture of iodine. She immediately became nauseated, and had a sense of severe burning in the pharynx and œsophagus. Copious draughts of water (a quart in all) calmed this without inducing vomiting, which, however, came on in the course of an hour, when a dark, thick, very bitter fluid and, finally, clear blood were ejected. Three or four hours after taking the poison the patient suffered with abdominal pains. In five hours she complained of dizziness, and in seven hours she had an attack of syncope.
>
> Treatment consisted chiefly of milk and starch-water. The first night was sleepless. The following morning she had moderate epigastric tenderness on pressure, and a sense of burning in the stomach, which disappeared in a couple of days. The urine was normal, and gave no trace of iodine. This was the case, also, with the sweat, saliva, and nasal mucus. Bellot (La Méd. Mod., Feb. 8, '93).

> Two cases related in which absorption of the tincture of iodine applied to the vaginal mucous membrane occurred. In the first case symptoms of intoxication appeared in six minutes. In the second case the application of iodine to the cervical cavity, in the course of treatment for an affection of the genital organs, resulted in the diminution in size of a goitre. Repin (Revue Méd. de la Suisse Rom., July 20, '93).

Treatment of Iodine Poisoning.—The usual antidote employed is starch, but white of egg or milk are, according to Trousseau, indicated by the greater affinity of proteid substances for iodine. The stomach should be emptied soon after the use of either of these substances to reduce the intensity of the subsequent effects. The other symptoms present should be treated on general principles, the tendency to collapse being combated by appropriate stimulants injected per rectum and hypodermically.

Therapeutics.—Iodine and its preparations are extensively used, but in syphilis, one of its salts, the iodide of potassium, may be said to be invaluable, especially in the tertiary form and all the manifestations of the disease in which the various organs are involved. As the indications are thoroughly reviewed under each special heading, including SYPHILIS, more than a reference here would be

superfluous. The best plan is to administer in increasing doses, beginning with 10 grains, three times a day, gradually increasing the dose by 1 grain a day until the limit of toleration is reached. Many patients reach 1 drachm and beyond, especially if plenty of pure spring-water is drunk simultaneously.

The indications for the administration of iodine are clearly given by Comby. Iodine is considered a specific in hereditary syphilis and in the tardy symptoms of acquired syphilis. In the initial and secondary stages mercury alone is sufficient; in the tertiary stage iodide of potash is indicated. An exception is made in the hereditary syphilis of the newborn, in whom the exhibition of iodide of potash should be begun early. Not only should positively syphilitic children receive iodine, but all who have suspicious symptoms, as coryza, exostoses, etc., or a cachexia which appears without apparent cause, or when the child is prematurely born, or the mother has had frequent abortions. In convulsions, pseudoparalysis, meningeal symptoms, etc., it is also indicated. The administration of iodine in children with gummy tumors, disease of bone, perforation of the soft palate and hæmoglobinuria is, of course, clearly indicated. Finally, in all parasyphilitic symptoms (Fournier), as hydrocephalus, cerebral tumors, partial epilepsy, etc., iodine is valuable.

In metallic poisoning iodide of potassium, by forming soluble salts with mercury and lead, causes these metals to be eliminated from the system. In painter's colic, therefore, wrist-drop, and other manifestations of lead poisoning and mercurial poisoning it serves an inestimable purpose. At times, however, either of these metals may lie practically dormant in the tissues, and suddenly find themselves brought into activity by the iodide of potassium, signs of severe poisoning following. When, therefore, there is good reason for the belief that considerable lead or mercury is lying in the system, the treatment should be started with small doses; this can then be very gradually increased—considerable water should be drunk to assist the process of elimination and reduce, by lowering as much as possible the specific gravity of the urine, lesions of the kidney.

It is generally accepted that sodium iodide is preferable to potassium iodide in all diseases of the respiratory tract and for certain rheumatic pains. The potassium salt is badly tolerated in many instances of hepatic disease, but is undeniably good in these cases. Where the patients do not tolerate iodide of potassium well, the employment of iodide of sodium first prepares them for the potassium salt.

Diseases of the Respiratory Tract.— In phthisis iodine has been recommended, but it is doubtful whether it is productive of much benefit. Inhalations of its vapor have been extolled as an excellent stimulant to the mucous membrane. The danger of hæmoptysis is always present, however, and is likely to be increased by stimulation of this kind.

In the early stages the local application of iodine over the threatened or diseased area is of great service. The front and back of the chest may be painted on alternate days, thus keeping the patient under the influence of the remedy. The application of cotton-wadding over the painted areas tends to increase the efficacy of the treatment.

In pleuritic effusions, pleurodynia, circumscribed pneumonia and bronchitis, the same proceeding is sometimes remarkably effective, especially if the region is kept warm.

Iodide of potassium and sodium can be employed with advantage in the chronic forms of croupous pneumonia and the pneumonia following or complicating influenza, beginning on or about the twelfth day of the disease. In doses of 23 to 30 grains per day for adults, and proportionately smaller ones in children. G. Zielinski (Univ. Med. Jour., July, '93).

Iodine diluted to $^1/_{10}$ or $^1/_5$ is a very useful application in whooping-cough, applied on cotton to the glottis. Labbe (Phila. Med. Times, Feb. I, '88).

Iodide of potassium is particularly valuable in asthma, especially when combined with belladonna. An efficacious preparation is the following:—

℞ Iodide of potassium, 2 drachms.
Water, enough to dissolve the iodide,

Then add:—

Tincture of belladonna, 2 drachms.
Syrup of orange-peel, enough to make 3 ounces.

Iodide of potassium employed not only in asthmatic dyspnœa, but in that of cardiac origin. G. Sée (Jour. de Méd. et de Chir., July, '88).

It is an error to suppose that potassium salts are especially poisonous to the heart. The sodium salt has no advantage, and is just as liable to produce iodism. The iodides are useful (1) for dyspnœa of a secondary nature, (2) in troubles of intrapulmonary circulation, (3) for reducing the volume of aneurisms, (4) for reducing the size of a tumor and thus relieving the symptoms of compression. G. Sée (Le Bull. Méd., Aug. 15, '88).

In the peribronchial enlargements so frequently encountered in scrofulous children the exhibition of iodine is often attended by considerable benefit, especially when combined with local applications. The syrup of the iodide of iron, given in 5-drop doses, three times daily and gradually increased, is especially valuable in this connection.

In naso-pharyngeal affections weak solutions of iodine in glycerin are of great value, when gently applied night and morning with a camel's-hair pencil or a pledget of cotton. Lacrymal disorders are also benefited by the same applications: when iodine is simultaneously painted over the thyroid cartilage, the effect is enhanced.

Good results obtained in the treatment of atrophic naso-pharyngeal affections from the application of pure tincture of iodine. After cleansing and using a 5-per-cent. solution of cocaine the iodine is lightly applied with a small brush of absorbent cotton. The applications are made at first every second day; later on, once a week. Hunter Mackenzie (Brit. Med. Jour., Apr. 27, '95).

Scrofulosis. — In scrofulous affections—so called—iodine fulfills a useful purpose. Lugol, who did so much to show the merits of iodine in this class of cases, is said to have obtained a large proportion of recoveries by means of the solution bearing his name as far back as 1828. Bazin recommended it especially in early manifestations before the cervical glands were too greatly enlarged, and when ulceration was not near at hand. All glandular enlargements, joint-enlargements, and osseous disorders are beneficially influenced by iodine used internally and externally simultaneously.

Rheumatism.—In this disease iodide of potassium is a valuable remedy, but only in the subacute or muscular form, *i.e.*, when the acute or inflammatory symptoms have passed. To give it during the inflammatory stage is worse than useless. It may be used, however, in rheumatic pains devoid of inflammatory manifestations, lumbago, sciatica. Its efficacy is vastly increased in all forms of rheumatism by the addition of colchicum. The following formula may be recommended:—

℞ Iodide of potassium, 2 drachms.
Enough water to dissolve this.
Then add:—
Tinct. of colchicum-root, 3 drachms.
Syrup of orange-peel, enough to make 3 ounces.
M. Sig.: One teaspoonful to be taken every three hours.

The local application of iodine over the painful area, this being then covered with cotton wadding, greatly hastens the curative process.

Goitre.—As shown in the section on Goitre (volume iii), iodine is of great value in this disease, and is now second only to thyroid extract when utilized in appropriate cases, namely: those suffering from the true hypertrophic variety. When the goitre is cystic, or the gland is but the seat of a neoplasm, benign or malignant, iodine is obviously useless.

Iodine has also been used with advantage in exophthalmic goitre.

Use of iodine by cataphoresis in an old case of goitre where subjective symptoms were very severe,—10 to 15 drops on cotton in cup-shaped electrode daily for three weeks,—intermission of three weeks—treatment persisted in for three weeks more.

The gland was reduced to about one-fifth the size it was when the treatment was begun, and, in spite of all further use of the remedy, remained stationary; but all of the subjective symptoms were gone, and the woman left in excellent health. Two other cases of chronic goitre have been treated in the same way, and with the same results. In 4 cases of recent hypertrophy of the thyroid gland in young women, the enlargement rapidly disappeared under the use of this measure. McGuire (Virginia Med. Month. Review, Aug., '91).

Case of simple goitre in which, after failure of the iodine treatment, the use of glycerol extract of the thyroid gland resulted in complete cure. Sabrazès (Berl. klin. Woch., Feb. 3, '96).

Skin Disorders.—Tincture of iodine applied over inflamed surfaces sometimes overcomes inflammatory disorders of the skin. Erysipelas, thus treated early, may be aborted; late in the disease, however, the results are not so satisfactory. It should be applied once daily. The pitting of small-pox may be greatly counteracted by touching each pustule with iodine. In acne, psoriasis, pityriasis, and ringworm it is also used advantageously. In actinomycosis (*q. v.*) iodide of potassium is the most efficacious remedy.

The writer has cured, with iodide of potassium, two cases of actinomycosis in man, one a tumor occupying all the submaxillary region, and on the region of the cæcum, considered at first as a perityphlitis. The doses were 7 ¾ to 31 grains per day in the first case, and 15 ½ grains per day in the second case, for sixteen days. V. Herson (Wiener med. Presse, Jan. 8, '93).

Surgical Uses.—Iodine possesses marked antiseptic properties, as first shown by Liebig. Fibrin immersed in iodized water does not undergo putrefaction. Pus treated with iodine does not have the fœtid odor after several days which can, without the iodine, be detected in a few hours when exposed to the air. The addition of a few drops of iodine to fœtid pus causes the odor to disappear.

Irrigations of iodine-water, of the strength of 1 to 10,000, used for the treatment of wounds, this to be followed by the application of either pure aristol or a mixture of 1 part of aristol to 4 of boric acid. Under such treatment luxuriant and profusely-bleeding granulations quickly returned to their normal appearance. Tikon von Popoff (Brit. Med. Jour., Sup., Aug. 1, '91).

A litre of spring-water may be sterilized in a few minutes by 4 drops of tincture of iodine; even less will cause the annihilation of pathogenic microbes. Meillère (La Tribune Méd., Dec. 26, '94).

Iodine trichloride is recommended for the treatment of tuberculous and suppurative processes. It may also be employed for cancerous surfaces and venereal sores, in 5- to 20-per-cent. solution in equal parts of water, ether, and glycerin. Solutions stronger than 5 per cent. cause smarting in ordinary wounds. The author states that gauze sterilized by boiling and dried, after being immersed in a 1- to 10-per-cent. aqueous solution, retains iodine trichloride for an indefinite time. Belfield (Med. Record, July 16, '92).

Good results obtained in the treatment of two cases of vesical tuberculosis and one of tubercular epididymitis by a 5-per-cent. aqueous solution of iodine trichloride. Belfield (Jour. Cut. and Genito-Urin. Dis., Aug., '92).

Excellent results obtained in the treatment of tubercular joint-disease, tubercular adenitis, and even in pulmonary tuberculosis, by the hypodermic injection of iodine in the following combination: from 1 to 5 parts of iodine, 10 parts of the potassium iodide, and 100 parts of distilled water; 1 cubic centimetre of this liquid being injected each day, using first the 1-per-cent. solution and gradually advancing to the 5-per-cent. solution. The injections of iodine should be continued for at least six months. Durante (Med. Week, '94, ii, p. 274).

Iodine injected into sinuses greatly aids in their closure. De Forest Willard (Annals of Surgery, Dec., '96).

External Application.—The tincture of iodine is extensively used as a counter-irritant. As such it may be said to have become a household remedy, and to be more or less beneficial in almost all ailments characterized by pain, except when abrasions are present. When applied over the skin, the latter becomes yellow and future applications gradually cause it to become brown. Burning and itching are then experienced; the applications had better be stopped until the distressing symptoms disappear. As already stated, poisoning can occur when too great an area is covered. As a rule, the surface covered should not exceed that represented by the two hands. When applied over the chest, its effects may be sustained by painting the front of the thorax one day and the back the next. A piece of cotton wadding placed over the surfaces thus treated enhances the efficacy of the iodine. In ophthalmology it is frequently employed in the treatment of trachoma.

The following method of employing iodine topically is of service. A piece of gutta-percha tissue is taken and given three or more coatings of tincture of iodine: it is then dried and applied in the selected locality, with the iodine coating turned toward the skin, and secured with a roller bandage. In this way the good results of the topical application of iodine may be secured without smarting. M. Iversen (Med. News, Apr. 20, '95).

Eymonnet has prepared a paper moistened with solution of potassium iodide and dried, and another paper prepared with potassium iodide and tartaric acid, moistened and dried. If these papers be kept separate and dry they will keep indefinitely. If a rubefacient be required, the papers are moistened and brought in contact with the skin. Iodine is liberated and causes a reddening of the skin, followed by desquamation. R. Lépine (La Semaine Méd., Jan. 30, '89).

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Iodine applied by painting is absorbed by the skin. This absorption, very small when the painted part is exposed to the air, becomes much more active when it is hermetically covered. The superficial alteration of the epidermis produced by the tincture of iodine, provided it does not go on to destruction of the corneous layer, appears to be an obstacle rather than an aid to absorption. Under the most favorable conditions the absorption is too irregular to make the painting of iodine useful in general iodine medication. Iodoform and ethyl-iodide are absorbed by the healthy skin, the latter in sufficient quantity to be useful, if

needful, for a general iodine treatment. Linossier and Lannois (Bull. Gén. de Thér., 9e liv., p. 385, '97).

Seventy-eight cases out of 100 cured with nascent iodine generated by administering potassium iodide internally, and, when the iodine begins to be eliminated in the lacrymal secretions, painting the upturned lid with oxygenated water. R. Roselli (Semaine Méd., July 20, '98).

Hypodermic Injection.— Hypodermic injections of iodine are extremely painful and give rise to considerable irritation. Iodide of potassium can be used hypodermically, however, and is not productive of so much pain if lukewarm water be employed.

Rectal Injections.—Rectal injections of iodine solutions have been used in colitis or in diseases in which this condition is the most prominent factor, dysentery and chronic diarrhœa, the ulcerative processes present being favorably influenced. One drachm of Lugol's solution in 1 pint of lukewarm water may be used after carefully cleansing the bowel by means of an enema. If pain is caused by the mixture employed, 1 drachm of iodide of potassium may be substituted for Lugol's solution, or a small quantity of extract of opium may be added. Two pints should be injected night and morning, the strength of the solution being increased if need be.

Study of the absorption of iodide of potassium from the rectum of healthy and sick persons; conclusions: 1. In eight healthy persons iodine could be discovered in the saliva in from five to nine minutes, the average being seven minutes. 2. In five patients with lesions about the rectum or in its neighborhood (cancer of the rectum, parametritis, retro-uterine hæmatocele, etc.) the absorption was retarded, the time varying between nine and fifteen minutes. 3. The same retardation occurred in seven patients with remote affections (acute nephritis, malignant disease of the stomach, cardiac organic disease, etc.), the time averaging about fourteen minutes. 4. When in the form of solution the iodide was absorbed by the rectal mucous membrane more rapidly than when in that of suppository, the difference amounting to several minutes. The iodide was introduced into the rectum either in aqueous solution—2 ½ drachms to 1 ½ ounces—or in suppositories containing the same amount of the salt. Baczkiewicz (Pamietnik Towarzystiva Lekarskiego Warszawskiego, '92).

The absorption of potassium iodide, when introduced into the rectum, is as rapid as when given by the stomach. If it be desired to obtain a still more rapid absorption, the solution may be heated from 95° to 98.6° F. The time during which elimination goes on is practically the same by either method of administration. With the weak solutions ordinarily given, elimination is complete in from twenty-four to thirty hours. Concentrated solutions are excreted more slowly,—that is, in from thirty-eight to forty hours. Calantoni (Riforma Medica, Apr. 26, '92).

Iodide of potassium detected in the saliva in about fifteen minutes after its administration by the mouth, and in ten minutes after its introduction through the rectum. Lemanski and Main (Le Bull. Méd., Jan. 29, '93).

The iodide of potassium, ingested by the rectum, is eliminated by the stomach, this elimination beginning from one-fourth to one-half hour before that occurring by the kidneys. P. Kandidoff (Wratsch, Apr., '93).

Parenchymatous Injections.— These are still considerably employed in hydrocele after evacuation of the fluid. The iodine is supposed to excite local inflammation and obliteration of the cavity. Hydatid cysts can also be treated advantageously in the same manner, a few drops of the tincture injected in the cavity being sufficient. In empyema the removal of the liquid by aspiration and the injection of a weak solution (6 grains of iodine and iodide of potassium to the pint, according to H. C. Wood) may be

used to wash out the pleura every day. If no untoward symptoms are observed, the strength of the solution can be increased. This solution may be used in washing out abscesses of all kinds. In cystic goitre parenchymatous injections have also proved curative (see GOITRE, volume iii).

Iodoform.

This precious agent was introduced by Sérullas in 1822, but was first used in practice by Bouchardat in 1836, then by Glover in 1837. Rhigini, in 1853, brought to light its great value as an antiseptic and disinfectant. Iodoform is obtained by the action of various alcohols or proteid compounds upon iodine (CHI_3), and occurs as small yellow crystals, having a penetrating persistent saffron-like odor, which adheres to every object with which the drug comes in contact. This peculiar odor is one of the greatest drawbacks of iodoform and has greatly contributed to limit its employment. Patients are rendered obnoxious to their friends, while the physician can with difficulty rid himself of the offensiveness incurred by its use as a remedy.

Among the methods recommended to deodorize iodoform without altering its therapeutic properties are the following:—

Oil of sassafras, 4 drops to the ounce of iodoform (Dodsley).

A few drops of any of the aromatic oils: almonds, musk, tar, etc. (Charteris).

Oil of evodia fraxinifolia, 2 drops to the ounce of iodoform (Helbing).

One part of menthol and 1 part of oil of lavender to 20 parts of iodoform (Cantrelli).

One part of menthol to 20 parts of iodoform (Caubrelle).

One or 2 parts of creolin to 100 of iodoform (von Jaksch).

To remove the odor from the hands or the clothes of the surgeon the readiest means is to use ether or chloroform (Washburn).

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Washing the hands with orange-flower water is sufficient to dispel the odor of iodoform after handling that substance. Constan (Lyon Méd., Nov. 28, '97).

Preparations and Dose.—In the treatment of wounds the powder is generally used, and with dangerous freedom by many surgeons. Thirty grains should be the limit for any single application of the drug, and a smaller quantity should be employed as a rule.

Internally, the powder may be given in doses ranging from 1 to 5 grains to adults.

Iodoform is insoluble in water, but soluble in ether, alcohol, and the fixed volatile oils. Ethylic alcohol saturated with camphor can dissolve eight times as much iodoform as pure alcohol.

Solutions of iodoform should be kept in red or green glass bottles, in order to prevent the liberation of iodine from them under the influence of light.

When glycerin or oil is used 5- or 10-per-cent. solution is generally preferred. The former is preferred for the treatment of serous cavities.

The iodoform-oil is of more value to the average physician than the iodoform-glycerin mixture, because of the ease with which it can be prepared and sterilized. The sterilization of the latter, however, may be done as follows: The glycerin should be heated by itself, and after it has been allowed to cool the proper amount of iodoform should be added. The advantages of this method are that the iodoform is not decomposed by the heat. Stubenrauch (Centralb. f. Chir., Dec. 10, '92).

At a temperature of 64.5° F. 67 parts of alcohol at 95 per cent. are required to dissolve 1 part of iodoform, while at the

boiling-point 9 parts at 95 per cent. are sufficient to dissolve 1 part; of ether, 5.6 parts are required to dissolve 1 part of iodoform. G. Vulpius (Pharm. Centralh. f. Deutschland, '93).

Saturated solutions of iodoform in ether become, as the point of saturation is reached, very unstable, and under the influence of the slightest causes they are decomposed suddenly, a reddish color resembling that of tincture of iodine resulting. The decomposition is rendered less rapid if the solutions are less concentrated. In saturated ethereal solutions it may be retarded by the addition of alcohol and by keeping them protected from sunlight.

The ointment of iodoform (U. S. P.) contains 10 per cent. of the drug.

Physiological Action.—Iodoform containing about 29 parts of pure iodine in 30, the carbon and hydrogen with which it is associated render the iodine nonirritant, either when taken by the mouth or applied topically. It is markedly anæsthetic when locally applied, owing to a benumbing influence upon the peripheral nerves. Defecation may follow the use of iodoform suppositories, and not be felt by the patient.

Iodoform tends to decrease the energy of cardiac contractions and reduces the number of pulsations. When toxic doses are administered the contractions become gradually weaker and the heart ceases its work in diastole. The action begins upon the nerve-trunks, then extends to the muscles. There is alteration of the blood-corpuscles, according to Floucaud.

Rummo has shown that the elimination of iodoform is extremely slow, though it begins soon after its ingestion. It leaves the organism by all the secretions and iodine may still be found in the urine three days after the iodoform is employed.

In dogs poisoned by iodoform Koriandère found inflammation of the glomeruli of the kidney and fatty infiltration of the liver, principally around the periphery of the lobules. In chronic cases he found, besides these changes, extreme emaciation, general anæmia, purulent bronchitis, rhinitis, conjunctivitis, and accumulation of pigment in the Malpighian bodies.

Untoward Effects of Iodoform.—Recently Hubener has shown that no essential difference in the toxic effects of finely powdered or coarse crystals of iodoform can be established by experimental research. Still, powdered iodoform is more quickly absorbed and diffused by the lymph-channels than the coarser form.

Experiments in animals have shown that, when used in the peritoneal cavity, iodoform has a distinct tendency to produce an inflammatory process, resulting in an excessive formation of adhesions. Consequently its use under such conditions should be restricted, and the sterile gauze employed whenever feasible.

Crystals of iodoform have been found to a large extent to become converted by the action of the tissues into minute vesicle-like granules. Prior to its ultimate breaking up into its chemical components, it undergoes a change into complicated iodine compounds, whose exact nature as yet remain unknown.

Many of the untoward results observed during the use of iodoform are due to impurities. In order to test the purity of iodoform, a practical plan is to shake a portion up with distilled water, filter, and treat the liquid with alcoholized solution of nitrate of silver. If in twenty-four hours no precipitate occurs, or only a slight grayish cloudiness, the iodoform may be regarded as pure.

When iodoform is employed, the use of

mercurials should be avoided. Its use along with carbolic acid is also fraught with danger.

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Mercurous iodide poisoning resulting from the use of iodoform as a surgical dressing and calomel internally. Simpson (Amer. Jour. of Obstetrics, Apr., '98).

The local symptoms due to iodoform are generally insignificant erythematous erosions, erysipelas, or simulated phlegmon, especially affecting the finer portions of the skin, as the face, eyelids, scrotum, etc. The conjunctiva, however, appears to be tolerant of the drug, and the eruptions are rarely observed in children. The local lesions are almost always due to the use of the powder and gauze. General symptoms may occur without any preceding local symptoms, the point of entrance being the stomach, lungs, or skin. Injections of iodoform-ether are rarely followed by accidents, though certain wounds predispose to such, especially those involving fatty tissue.

The clinical signs are a sudden rise of temperature (102.2° to 104° F.) and the appearance, on the same day or the following day, of an eruption, often of the scarlatiniform or erythematous type. Internal symptoms may exist at the same time or alone, such as dislike for food, burning sensation in the epigastrium, vomiting, and nausea. All these phenomena may be sufficiently severe to cause death. (Chéron.)

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What may be termed "surgical iodoformism" is sometimes met with. After a longer or shorter period of complete toleration the wound, while secreting no pus, is surrounded by an inflammatory area with development at its circumference of inflammatory vesicles (iodoformic herpes). Petechiæ appear near the wound or at a distance in patches or groups. The wound stagnates and inflames, but does not heal. A generalized pruritus along the collateral nerves of the fingers follows, succeeded by diffuse phlyctenulæ. Areolar or pseudo-erysipelatous lymphangitis appears in the affected limb. If the use of iodoform is persisted in lymphangitis progresses, the tongue becomes coated, and the patient is agitated and sleepless. A phlegmonous condition with general symptoms develops, and necrosis may threaten the patient with loss of limb or life. Tussau (Semaine Méd., Nov., '96).

Case of a woman in good health, who died of iodoform poisoning. On the left leg was a small varicose ulcer which had been dressed with iodoform powder. After this treatment tumefaction set in and the leg became red and painful, and at the end of eight days there was a generalized eruption. Editorial (Revue Méd. de la Suisse Rom., p. 431, '96).

Case of a woman who sustained burns of the thighs and abdomen to which iodoform dressings were applied. After three weeks without other signs of general poisoning a progressive amblyopia appeared, accompanied by atrophy of the temporal half of both disks. Terson (Société de Biol.; Annales d'Ocul., Nov., '97).

The toxic effects of iodoform are well illustrated in the three subdivisions of symptoms proposed by McLean:—

1. Cutaneous irritation: Eruptions of the skin in erythematous or eczematous form, associated with the pruritus of urticaria.

2. Cerebral disturbances: Headache often very marked; delirium more or less active; melancholia, hallucinations; the pupils occasionally dilated, but more often contracted and motionless; the pulse decidedly accelerated, running early up to 135 to 150 per minute; quality rather small and wiry; rapid increase of temperature.

3. Syncopal or asthenic form of poisoning: Patient overcome with dizziness, mental confusion, great lethargy;

weak, rapid pulse; some paralysis of the sphincters, death coming sometimes suddenly by heart-failure.

The quantity thought capable of causing death has been estimated at 1 drachm in a case witnessed by Langenstein, but it is probable that in the majority of cases this dose would not prove fatal. Czerny has reported a death after 1 $^1/_2$ drachms had been taken. It is probable, however, that the susceptibility of the patient bears considerable influence upon the results. This susceptibility may, in turn, be to a degree under the influence of the varying conditions of the patient's resistance, etc. The smallest dose thought to have caused death (1 drachm) should therefore be considered as likely to give rise to dangerous symptoms in any case, although larger doses have been taken with impunity.

> Case of a woman who took 2 drachms of iodoform at one dose, with no evil results. The only symptoms manifested were severe headache, griping pains in the abdomen, and purging. The taste in the mouth and the odor of the drug in the breath of the patient remained for several days. H. W. Frauenthal (N. Y. Med. Jour., Jan. 11, '91).

Treatment of Iodoform Poisoning.— The active symptoms of iodoform poisoning may sometimes be prevented by timely measures when the preliminary signs appear. It is important to know, however, whether iodoform intoxication is really present. This may be ascertained, according to Sasse, by the following means:—

A test is made of the urine to note the quantity of iodine which is eliminated by it. A small pinch of powdered calomel is placed upon a saucer, and then a few drops of the urine to be examined are dropped upon it; a mixture of the urine and calomel is then made with a glass rod. If the urine contains a notable amount of iodine there is produced a well marked yellow discoloration, which should indicate that the iodoform is being absorbed in sufficient quantity to produce danger.

The immediate removal of the drug from the surface in cases of surgical-dressing intoxication is of obvious importance. This can easily be done by means of a warm solution of starch, which takes up all the free iodine that is present. Alcohol and hot water may be used instead. The local conditions are then treated symptomatically, a few doses of bromide of potassium being given internally to assist in counteracting the poisonous effects.

When a large dose has been taken internally, the stomach should be emptied and 20 grains of bromide of potassium given in a half-tumblerful of water. Four 10-grain doses should then follow every hour. This salt is thought to be a positive antidote, owing to its power as a solvent of chloroform.

> The antidotal property of potassium bromide explained by stating that it excells all other salts in regard to its solvent property for iodoform. Samter and Retzlaff (Wiener med. Blatter, July 11, '89).
>
> Bromide of potash acts as an antidote to iodoform not only as a neutral potash salt, but also by virtue of its specific bromide action. Joseph Samter (Berl. klin. Woch., Apr. 15, '89).
>
> Twenty-per-cent. solution of bicarbonate of potassium administered to a case of iodoform poisoning. The best results followed, the medicine seeming to act as a direct antidote. Behring (Ther. Gaz., Mar., '88).

Therapeutics.—The use of iodoform in the treatment of wounds and ulcerative processes has become so general that a list of its indications would serve no useful purpose. The manner in which

iodoform produces its effects, however, will prove of practical interest.

In the powdered state, iodoform has been shown by de Ruyter, Kronacher, Baumgarten, Heyn, Drovsing, and others to possess but little, if any, value as an antiseptic in laboratory experiments, notwithstanding its undoubted value in practice. It was found, when mixed with rapidly infective bacteria, in no way to reduce the development of disease in animals. Even the bacillus tuberculosis, though previously mixed with powdered iodoform, when introduced into guinea-pigs produced tuberculosis precisely as if no antiseptic had been employed. Again, it was found to have no direct effect in preventing the development of staphylococcus pyogenes, the coccus pneumoniæ, or other well-known organisms.

Far different were the results, however, when the solutions in which decomposition of the iodoform has already begun were utilized. Organic fluids, blood, serum, in which micro-organisms are undergoing the process of development possessing the property of decomposing iodoform, its antiseptic powers, though unexplained, are nevertheless accounted for. In other words, the properties of iodoform are due to its decomposition, and the activity displayed is proportionate to the energy of the chemico-physical process involved. Whether the decomposition is due, as is believed by many, to ptomaines, local stimulation, or other effects is not fully established.

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If wounds inflicted on dogs or guinea-pigs are infected with staphylococci or streptococci and are treated with iodoform, they heal more quickly and secrete less than those which are not thus treated. Iodoform lessens the virulence of these micro-organisms; neutralizes or destroys the microbe toxins, but not completely; it does not lessen the amœboid motion or the phagocytosis of the white blood-corpuscles. Lomry (Archiv f. klin. Chir., B. 53, H. 4, '96).

Iodoform is not used in surgery as it was a few years ago, although it may safely be said that, all advantages considered, no drug has shown itself entitled to its place. Its unpleasant odor has alienated the majority of those who have abandoned it. Its present *status* among surgeons at large is well represented by the varying views expressed at a recent meeting of a surgical society:—

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Use of iodoform is not increasing, but, on the contrary, it is decreasing. Acetanilid gauze has largely superseded it. T. G. Morton.

The writer uses iodoform very little. Thymol-diiodide is cheaper and better for fresh wounds. Thymol and acetanilid are sufficient for nearly all cases. De Forest Willard.

Not used by writer as much as formerly, but it is a very good remedy in certain cases, as in bone-cavities and especially in cases of abscess about the rectum, where no packing can take its place. Used in the same way in operations about the mouth iodoform packing remains sweet longer than any other packing. H. R. Wharton.

The employment of iodoform in personal practice limited to its use as a gauze for packing and drainage, especially where dryness and antisepsis are required for prolonged periods; as an injection in emulsion with glycerin for tubercular joints or abscesses; and, occasionally, in the shape of a 5-grain suppository in tubercular affections of the rectum. Thomas S. K. Morton.

There are two classes of cases in which powders are used antiseptically, one in which the drying element is desired and the other in which antisepsis is to be obtained. In the latter case there is not anything to be compared to iodoform. Iodoform is the most reliable agent to stop suppuration when actual contact can be secured. G. G. Davis.

The writer has not been able to find anything which would take the place of iodoform in securing cleanliness in a moist cavity. George Erety Shoemaker.

Routine use of iodoform to the exclusion of other dressings equally as good and free from the many objections protested against. W. G. Porter.

Iodoform is still a valuable drug. It is used nearly as much to-day as ten years ago. R. H. Harte.

The rational use of iodoform is as much indicated to-day as it ever was. It is useful in chancroids, and nothing can take its place. W. Joseph Hearn. (Annals of Surgery, May, '98.)

Surgical Tuberculosis.— It is in the treatment of tubercular conditions amenable to surgical interference that iodoform finds its main application as a curative agent.

In the treatment of joint-tuberculosis our associate editor, Dr. L. S. Freeman, recommends, with many other able surgeons, a 10-per-cent. suspension in olive-oil. His directions may be summarized as follows: Absolute cleanliness should be observed. The iodoform should be soaked for twenty-four hours in a 1 to 1000 solution of bichloride of mercury, which is stirred occasionally with a glass rod to make sure that the solution touches every particle of the powder. It is then filtered, employing a filter-paper through which has been poured a quantity of boiling water. The remains of the bichloride are then washed away with sterilized water. The iodoform is removed from the filter with a surgically-clean knife, and rubbed up with the oil in a sterilized mortar, about 4 per cent. going into solution and 6 per cent. remaining in suspension. The oil is best rendered germ-free by keeping it at the boiling-point for about half an hour. If the mixture is kept in a dark place in a sterilized bottle stopped with germ-free cotton, it will not deteriorate for a long time.

The injections should be made both into the joint-cavity and into the surrounding infected tissues. It is best to but partially withdraw the needle and insert it in a new place rather than to make a number of punctures in the skin.

If tubercular pus is present, it should first be withdrawn.

One syringeful of a 10-per-cent. suspension of iodoform is an average dose. It is well to begin with a moderate quantity and watch carefully for symptoms of iodoform poisoning—which, however, seldom appear.

In general, the injections can be repeated every two or three days over a period of several weeks, and then continued at intervals of a week or two.

The following formula given for an iodoform emulsion for injection into tuberculous fistulæ: Iodoform, 3 parts; starch, 1 part; mix until a fine powder is obtained and add glycerin, 20 parts; water, 12 parts; heat gradually, stirring the mixture constantly, up to 271.4° F. The emulsion of 10 per cent. thus obtained is very stable, while that ordinarily prepared by triturating iodoform in glycerin and heating is very unstable, the iodoform soon precipitating. R. H. Lucy (Brit. Med. Jour., Jan. 7, '93).

Twenty-one tuberculous abscesses, with 16 complete cures, treated by routine of iodoform in sterilized oil or glycerol, a 10-per-cent. solution. Abscesses in tubercular arthritis, accompanied with grave suppuration, were most rebellious to the iodoform injections. Four cases had symptoms of poisoning, 2 of which had attacks of acute nephritis. Wieland (Deut. Zeit. f. Chir., xli, 4, 5).

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In 39 cases of tuberculosis involving the wrist, treated by iodoform injections after the manner originated by Bruns, 24 were permanently cured, while, with 15 more, other measures had to be resorted to.

Iodoform was used in the form of an olive-oil emulsion of a strength of 10 to 20 per cent., and in the granulating form of the malady from 30 to 120 minims were injected; but where abscesses had been emptied, from 3 to 9 drachms were employed. Briegel (Beit. Z. klin. Chir., B. 20, '98).

In tubercular laryngitis the local use of iodoform has also been followed by excellent results. The ulcerative surfaces being carefully cleared of their muco-purulent discharges by a detergent spray, the ether solution of iodoform recommended by Elsberg (1 part of ether and 4 parts, crystallized, of iodoform, shaken in a red bottle) is then topically applied. This should be repeated frequently. In hæmorrhagic disorders complicating tuberculous processes it is also of value. In tubercular aural diseases its use is as satisfactory as it is elsewhere.

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Two cases of primary tuberculosis of the larynx cured by spraying with a solution of iodoform in ether following a spray of cocaine. To be efficient the iodoform treatment must be adopted before ulceration takes place. Newman (Jour. of Laryn., Mar., '96).

Seven cases of tuberculous laryngitis cured by general treatment and lactic acid and iodoform locally. Bernengrun (Arch. Laryn., ii, p. 2; Quart. Med. Jour., Jan., '96).

Excellent results in two cases of early phthisical hæmoptysis from the use of iodoform in eucalyptolized oil, beginning with a daily dose of $^3/_4$ grain. The hæmoptysis ceased by the third day. Gallot (Gaz. Hebdom. de Méd., Sept. 1, '98).

Internal Use.—The employment of iodoform by the mouth has never received much support. In pulmonary tuberculosis it has been tried by many clinicians, but the results have generally been disappointing, notwithstanding Gosselin's experiments showing that guinea-pigs, when saturated with iodoform, could stand with impunity inoculations with tubercular material. Its use in other diseases has been barren of results when tried by several observers. Even in syphilis its effects have not, as a rule, been satisfactory.

Inunctions. — Recently, Flick, of Philadelphia, after an experience of eight years, has recommended the use of iodoform by inunctions in the treatment of pulmonary tuberculosis. Europhen may be used instead; in fact, the last preparation is preferred by the author. The mixture is composed as follows: Iodoform or europhen, 1 drachm; olei rosæ, 2 minims; olei anisi, 1 drachm; olei olivæ, $2\,^1/_2$ ounces. About a tablespoonful of the solution is rubbed into the skin of the inside of the thigh and into the armpits at night.

By means of this treatment, chiefly among the out-patients, he comes to the conclusion (1) that incipient cases can always be cured; (2) that cases advanced to the breaking-down stage may be improved very much, and sometimes may be cured; (3) that the treatment ought to be continued even after the acute symptoms have disappeared, and should be maintained until perfect health is reestablished. Flick gives creasote and tonics while using the inunction treatment. A combination of the two methods—viz., the creasote and tonic with the inunction treatment—gives better results than either separately.

Substitutes for Iodoform.—Quite a large number of substances have been recommended as possessed of the therapeutic properties of iodoform, without presenting its untoward features. The best known of these are the following:—

Airol, a gallate of bismuth and iodine, is a light-grayish-green powder, stable in dry air, but when left in contact with

moisture iodine is gradually liberated. It is insoluble in water, alcohol, and ether. Airol is astringent and desiccative, as well as being antiseptic.

Antiseptol (iodosulphate of cinchonine) is an odorous brown powder, which has been recommended as a substitute for iodoform. It contains half its weight of iodine, and is soluble in alcohol or chloroform, but is insoluble in water.

Aristol (di-thymol-iodide) is a reddish-brown powder containing 45.8 per cent. of iodine. It is insoluble in water, glycerin, or alcohol, but soluble in ether or oils.

Aristol has been used successfully in various skin affections: psoriasis, eczema, rhinitis, ozæna, and lupus, but has proved unsatisfactory in lichen rubra, soft chancre, and gonorrhœa. Aristol has a certain effect on venereal ulcers, but acts very slowly; the only advantage it possesses over iodoform is absence of smell—its activity is inferior. It has been found of service in the first and second stages of pulmonary tuberculosis when no cavities exist. It also lessens cough and night-sweats. Burns and scalds have been successfully treated with aristol, and the application in a powder to the cornea in keratitis and in an ointment in corneal ulcers has given good results. It is of great value in nasal affections; it lessens the discharge, relieves pain, and stops bleeding when used as an insufflation in cancer of the cervix uteri.

Di-iodoform is an ethylene-periodate and consists of carbon, 4.62 parts; and iodine, 95.38 parts. It occurs in yellow crystals, is insoluble in water, slightly soluble in alcohol and ether, but dissolves readily in chloroform, carbon disulphide, benzin, and hot toluene. If kept in the dark it remains practically odorless. The compound is an exceedingly stable one. It is said to be well borne by the stomach and to be much less toxic than iodoform.

Europhen (iso - butyl - ortho - cresyl - iodide) occurs as a pale-orange, non-crystalline powder, containing 28 per cent. of iodine.

Europhen possesses powerful antiseptic properties, and, being resinous to the touch, it adheres well to mucous membrane and wound-surface, and does not easily cake. It is non-poisonous, and acts only when brought into contact with secreting surfaces, which decompose it and liberate iodine. It is especially useful in dentistry. Europhen may be used with advantage in all cases where iodoform has been employed.

Iodol (tetra - iodo - pyrrol) contains about twenty-seven parts in thirty. It is obtained by precipitating pyrrol with iodo-iodate of potassium. It is a microcrystalline, brownish-white powder, having a faint thyme-like smell, and is soluble in water. Iodol is said to be non-toxic: a statement which should not be accepted with absolute confidence. Still, that it is much less likely to produce untoward symptoms than iodoform is certain.

Iodol may be used in all conditions for which iodoform is indicated. It constitutes an excellent antiseptic for all kinds of ulceration, including those of a specific nature. Iodol has been used with good results in gonorrhœal affections, hard and soft chancres, and various disorders of mucous membranes, including the conjunctiva. It possesses some anæsthetic action, and acts as an astringent when the discharge is copious.

> Iodol possesses especial value for internal medication, because it is harmless, tasteless, and odorless, and also because of the large amount of iodine contained in it and the free elimination of this iodine in the system. The author has used iodol in the treatment of scrofulosis,

diseases of the respiratory tract, and in tertiary syphilis. In the treatment of scrofulosis the iodol was given continuously for two or three months in daily doses of 7 3/4 to 23 grains. In adenitis, besides the above treatment, a salve composed of 1 part of iodol and 15 parts of vaselin was used.

Inhalations and insufflations were added, with success, to the internal treatment. Cervesato (Berl. klin. Woch., Jan. 14, '89).

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Iodol-ether is a 10- to 20-per-cent. ethereal solution for injection into fistulous tracts and for sprays. By spraying it upon the gauze with which a wound has been bandaged an excellent iodol gauze is had. (Pharm. Centralb., xxxvii, p. 475, '96).

Iodol used in about eight hundred cases of soft and hard chancre and erosion of the neck of the uterus. In soft chancre a healthy granulation was quickly obtained at the base of the ulcer, while in hard chancre the induration quickly disappeared. An important point in the treatment, and one essential to its success, is that the base of the ulcer should always be carefully cleansed, in order to prevent decomposition of the iodol. Majocchi (Univ. Med. Jour., Feb., '96).

Iodosalicylic and *diiodosalicylic acids* are iodine compounds of salicylic acid in which one and two atoms of hydrogen, respectively, are replaced by iodine. Diiodosalicylic acid contains 20 parts of iodine in 30, iodosalicylic acid 15 in 30. Iodosalicylic acid and diiodosalicylic acid are powerful antiseptics. They possess the combined action of iodine and salicylic acid, and have been successful in the treatment of acute polyarticular rheumatism where salicylates have failed.

Loretin (meta-iodo-ortho-oxy-chinolin-ana-sulphonic acid) is a bright crystalline powder, odorless, and similar in appearance to iodoform. It is very slightly soluble in water or alcohol, and insoluble in ether, but forms soluble salts with alkalies, except with lime. Loretin is non-poisonous and unirritating, and has been used with good effect on burns, ulcers, and other wounds.

Losophan (meta-tri-iodo-cresol) contains 24 parts of pure iodine in 30. It is a grayish crystalline powder, soluble in alcohol, chloroform, oils, and fats. Losophan has been found useful in parasitic skin affections, but it is apt to cause irritation.

Sozoiodol (di-iodo-para-phenolsulphonic acid) is composed of 54 per cent. of iodine, 7 per cent. sulphur, and 20 per cent. phenol. Sozoiodol has been found useful in the treatment of whooping-cough: 3 grains blown into each nostril once daily. A solution of sozoiodol-mercury with iodide of sodium has been recommended for intramuscular injection in syphilis. (Brit. Med. Jour., Sept. 18, '97.)

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Iodoformogen used as an application to recent wounds. After the bleeding had stopped the wounds were dusted with the powder, then sewn, and a thin layer of the powder applied over all. The wounds were, as a rule, rapidly and very satisfactorily healed. Wounds of 2 centimetres and larger, in which there was considerable tension, were also treated without suturing, in order to see if iodoformogen would be able, on account of its great adhesiveness, to firmly adhere to the margins and heal the wounds. As a rule, excellent results were attained in these cases. Schmidt (Amer. Medico-Surg. Bull., July 25, '98).

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IPECAC.—Ipecac is the root of the *Cephaëlis ipecacuanha* of A. Richard: a small shrub indigenous to Brazil, and belonging to the *Rubiaceæ*. It is also cul-

tivated in India. Ipecacuanha contains an alkaloid called emetine, a glucoside called ipecacuanhic acid which resembles quinic and caffe-tannic acids, gum, resin, starch, a volatile oil, lignin, and sugar. The powdered root has a slight, but characteristic, nauseous taste. The alkaloid, emetine, usually described as white in color, is more usually, as noted by Merck, a light brownish, crystalline powder, of a bitter taste, and darkening upon exposure. It is soluble in alcohol and chloroform, slightly soluble in ether, and very slightly soluble in water. It is present in the root in a proportion of somewhat less than 1 per cent.

The presence of three distinct alkaloids has been indicated in ipecacuanha. The powdered drug is exhausted with alcohol, treated with basic lead acetate, and filtered; the filtrate is evaporated to dryness and the residue so obtained dissolved in dilute H_2SO_4. After the filtration the clear solution is treated with ammonia. The ammoniacal liquor is then shaken with ether, which removes the two principal alkaloids,—cephæline and emetine. The third, existing in very small quantity, remains in the alkaline liquid, from which it may be removed by chloroform. It is a yellow crystalline body. Cephæline and emetine are separated by a solution of caustic alkali, the former alkaloid being soluble in that liquid. Cephæline ($C_{14}H_{20}NO_2$) is a crystalline, monacid base, forming crystalline salts. Emetine ($C_{15}H_{22}NO_2$) is a non-crystalline, monacid base; it, however, forms very well defined crystalline salts. Both alkaloids in the free state are colorless, but are decomposed by light and turn yellow; their salts, on the other hand, are perfectly stable and afford a means of administering these substances unaltered.

The so-called ipecacuanhic acid is, in all probability, a mixture of a glucoside resembling saponin and a substance giving a dark-green color-reaction with $FeCl_3$. Paul and Cownley (Pharm. Jour. and Trans., London, vol. liii, p. 61; vol. liv, pp. 111, 373, 690).

Preparations and Doses.—The powdered root of ipecacuanha, $^1/_2$ to 30 grains.

The fluid extract (Extractum ipecacuanhæ fluidum), 1 minim to 1 fluidrachm.

The syrup (syrupus ipecacuanhæ), 5 minims to 6 fluidrachms.

The wine (vinum ipecacuanhæ), 5 minims to 1 fluidrachm.

The tincture of ipecac and opium (tinctura ipecacuanhæ et opii), 5 to 15 minims.

The troches of ipecacuanha (trochesci ipecacuanhæ), 1 to 2 troches.

The troches of morphine and ipecacuanhæ (trochesci morphinæ et ipecacuanhæ), 1 to 2 troches.

The powder of ipecac and opium (pulvis ipecacuanhæ et opii—Dover's powder), 5 to 15 grains.

Emetina, non-official, $^1/_{120}$ to $^1/_8$ grain.

Emetinæ hydrochloras, non-official, $^1/_{120}$ to $^1/_8$ grain.

Physiological Action.—Ipecac when applied locally to the mucous membranes and to the skin acts as an irritant. It gives rise to a papular eruption, which becomes pustular and proceeds to active ulceration if the application is persisted in. Internally, small doses frequently repeated give rise to nausea and increased flow of saliva and bronchial secretions. In persons sensitive to its influence vertigo and flushing may appear in addition.

Peculiar case of idiosyncrasy to ipecac. Nausea, vertigo, and flushing of the face manifested themselves after the administration of a little less than 2 drops of the wine of ipecac. Ernest Sangree (Times and Register, Aug. 10, '89).

In large doses these effects are increased in intensity, and vomiting occurs without producing excessive prostration, an excess of the drug being ejected before it has had time to induce very depressing effects.

These effects are mainly due to cephæline and emetine, as the two principal alkaloids of ipecacuanha possess—as shown by R. B. Wild—a powerful emetic action: the emetic dose of the latter (the hydrochloride) is, however, about double that of the former. In non-emetic doses the degree of nausea produced by cephæline is also about double that produced by emetine.—*e.g.*, the intensity and duration of nausea following cephæline are much the same as that following double the amount of emetine. Both alkaloids lower arterial tension, and little difference is apparent in small doses, but the depression produced by cephæline is less than that produced by the larger emetic dose of emetine. They cause contraction of the blood-vessels after destruction of the brain and spinal cord; but emetine is distinctly more active than cephæline: 1 in 10,000 of the latter produces little, if any, effect, while 1 in 20,000 of emetine is followed by marked contraction. Cephæline is practically free from depressing effects when given in doses of $^1/_{16}$ to $^1/_6$ grain, but its action as an emetic is slow.

The irritating action of the drug upon the stomach is thought to represent the most active factor, though d'Ornellas has shown that hypodermic injections of emetine also produce emesis in animals. The action upon the central nervous system has not been established, but the contradictory evidence available would tend to show that it is but slightly influenced. It tends to depress cardiac action and has caused death in animals by paralyzing the heart. The pulmonary system seems to be depleted of its blood, judging from the pallor of the tissues post-mortem, an active hyperæmia of the gastro-intestinal tract apparently acting as compensating factor.

Poisoning by Ipecacuanha. — In the lower animals lethal doses of emetine cause death by paralysis of the muscles of respiration, the heart continuing to functionate after respiratory movements have ceased. The surface-temperature falls, but the internal temperature either remains stationary or suffers a slight rise, owing to the irritant action of the emetine upon the intestinal mucous membrane (d'Ornellas).

Post-mortem examination of animals killed by emetine reveals considerable gastro-intestinal irritation.

> Case of a woman, 48 years of age, suffering from bronchitis, to whom a 6-ounce mixture containing 1 ounce of the syrup of ipecacuanha was administered. The patient was immediately seized with a violent, obstinate, and prolonged attack of vomiting each time she took a teaspoonful of the mixture. So susceptible was the woman to the smallest quantity of the drug, that it had to be omitted from the cough-mixture altogether. Several experiments tried on the same case, always with the same result, though somewhat modified by the quantity used in each dose. The patient suffered from no other bad effects of the ipecacuanha. E. L. Morgan (Va. Med. Monthly, July, '92).

The lungs are generally hyperæmic and present patches of hepatization; less frequently they are exsanguinated. The internal use of ipecacuanha is sometimes followed by urticaria.

Treatment of Poisoning by Ipecacuanha.—Poisoning by ipecac or its alkaloid, emetine, is rare. The indications, however, are to remove the drug from the stomach, if possible, by means of the stomach-pump. External heat, whisky, ammonia, strychnine, and other respiratory stimulants should be resorted to.

Therapeutics.—Ipecac is a safe and efficient emetic. It is free from depressing and irritating effects when given in ordinary doses. On the other hand, it is sometimes slow in its action. Ipecac in

emetic doses (4 to 20 grains of powder or 1 to 3 drachms of the syrup) may be used to empty the stomach in cases of acute indigestion, migraine, or bilious sick headache. In membranous croup, asthma, capillary bronchitis, lodgment of foreign bodies, pertussis, and in laryngismus stridulus it may be employed in emetic doses for its mechanical effects. In the bronchitis of small children, who swallow the mucus coughed up from the lungs instead of spitting it out of the mouth, emetic doses of ipecac will relieve the stomach and improve the condition of the lungs.

As an emetic in cases of poisoning it is inferior to mustard or the sulphate of zinc or copper on account of its less efficient and slower action.

As an antemetic, in small doses ($^1/_{10}$ to $^1/_4$ grain of powder or $^1/_2$ to 1 minim of wine) repeated every half-hour or hourly, ipecac holds a high place. Given in this way we find ipecac useful in obstinate vomiting of drunkards, in the vomiting of pregnancy, the vomiting of migraine, and especially in nervous vomiting and the morning vomiting which sometimes accompanies general weakness of convalescents from acute diseases. In the vomiting of children, with acute catarrh of the stomach, ipecac is useful. Ringer notes that ipecac has a greater influence over the vomiting of children than over that of adults. The vomiting occurring with cancer of the stomach is sometimes relieved by ipecac after the more commonly used remedies have failed (Ringer). Small doses ($^1/_{10}$ to $^1/_6$ grain of ipecac) are found beneficial where insufficient excretion of bile and torpor of the liver are present. In flatulent dyspepsia small doses ($^1/_{10}$ to $^1/_4$ grain) given after meals are followed by a subsidence of the flatulence. One grain of pulverized ipecac taken fasting every morning will remove the dyspepsia associated with constipation, depressed spirits, flatulence, cold extremities, and a feeling of weight in the stomach.

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Case of a woman who had been subject to epileptic fits from the age of eight years. She had been more or less under treatment. Finally the bromide was reduced to a third of the former dose and vinum ipecacuanhae added. A commencing dose of 10 minims was increased from time to time as the fits recurred, until 40 minims three times a day were given. The severity and frequency of the fits diminished under this treatment until May 3, '98, since when no fits have occurred. C. Knox Bond (Lancet, Sept. 17, '98).

Disorders of the Respiratory Tract.—In the early stage of bronchitis, when the secretion from the lungs is abundant and tenacious, ipecac will do good service in non-emetic doses. Murrell and Ringer recommend the inhalation of wine of ipecac, in the form of a spray produced by a hand-atomizer, in the treatment of winter-cough and bronchial asthma. The wine may be used pure or diluted with 1 or 2 parts of water. At the first application it sometimes excites a paroxysm of coughing, which generally soon subsides; but, should it continue, a weaker solution should be used. As a rule, the patient at first will bear about 20 compressions of the bulb without nausea. The inhalation should be used at first daily, and in bad cases two or three times daily, afterward every other day suffices, and the interval may be gradually extended. As the spray is used for its topical effect, the patient is directed to spit out, or even to rinse out, the mouth at each pause in the administration, for a much larger quantity of the wine collects in the mouth than

passes into the lungs. In this way nausea and even vomiting are avoided.

> Spray of ipecacuanha has given successful results in chronic bronchitis and bronchial catarrh. A single inhalation will sometimes restore the voice in hoarseness due to congestion of the vocal cords, and most cases of winter-cough will be relieved in ten days. The spray should be used warm for about ten minutes three to four times a day, and the patient should not go out for some minutes after inhaling. Either a hand-ball, spray-apparatus, or a steam-vaporizer may be employed. W. Murrell (Med. Press and Circular, Apr. 25, '88).

Hæmorrhage.—Ipecac possesses undisputed antihæmorrhagic properties. It may be used alone or combined with ergot or some other antihæmorrhagic agent. For this purpose ipecac should be given in frequently-repeated doses until vomiting ensues. It has been successfully used in hæmoptysis, epistaxis, menorrhagia, post-partum hæmorrhage, etc.

> Ipecacuanha in emetic doses of 15 grains every ten minutes is the most powerful hæmostatic in severe hæmoptysis of phthisical patients. C. Bernabei (Boll. della sez. della Sci. Med., No. 2, '87).

The wine of ipecac given in doses of 10 to 15 grains has been successfully used in uterine inertia in the first and second stages of labor.

Intestinal Disorders.—In acute dysentery ipecac is especially efficient. When the passages are large and bloody and the type is malignant, 60 to 90 grains are given first to produce vomiting. After vomiting has been induced small doses of 2 to 3 grains are given every hour, and continued until a profuse black stool occurs. This latter is a favorable prognostic sign; its non-appearance is significant of danger. The great depression is counteracted by the free exhibition of stimulants, and the vomiting by the use of opium and sinapisms to the epigastrium.

> Case of dysentery of diphtheritic type in which there was steady deterioration under the use of opium and almost instant improvement and eventual recovery under the use of ipecac. R. P. Jones (Dublin Jour. Med. Science, Aug. 1, '94).

In choleraic diarrhœa and cholera morbus ipecac, in dose of 3 grains, given every two hours, is followed by good results.

Skin Disorders.—Ipecac is excreted in part by the skin (Binz), and we find that its diaphoretic properties may be utilized in the beginning of fevers, colds, and other inflammatory conditions, for which purpose it is associated with opium as in the official "pulvis ipecacuanha et opii." In the dermatitis caused by rhus toxicodendron the free application of a wash consisting of 3 drachms of powdered ipecac to a pint of water is recommended by W. S. Gilmore. Neall recommends the use of 1 pint of powdered ipecac to 8 parts each of alcohol and ether to relieve the inflammation caused by mosquito-bites. Powdered ipecac made into a paste and smeared on the skin is said to relieve the pain and swelling produced by the sting of bees.

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> Ipecacuanha tried several years in Nicaragua, Central America; notwithstanding its vaunted efficacy, in dysentery no case derived much benefit from it. Patients suffering from dysentery could not always retain the large doses recommended in text-books. But ½-ounce doses of a saturated solution of magnesium sulphate and 15 minims of dilute sulphuric acid every two hours, with milk diet, caused all traces of blood to disappear from the stools in twenty-four hours, and there was a complete absence of the distressing nausea which is always present in the treatment by ipecacuanha. T. R. Wiglesworth (Brit.

Med. Jour., Feb. 26, '98). (See DYSENTERY, volume iii.)

Ipecacuanha used in about 50 cases of anthrax during the last fifteen years and without a single failure. The writer applies it externally, mixed with water to the consistence of cream, and administers it in full doses internally. In carbuncle, too, it appears to be a specific. E. B. Muskett (Lancet, Feb. 11, '89).

C. SUMNER WITHERSTINE,
Philadelphia.

IRIDECTOMY. See CATARACT.

IRIS, CILIARY BODY, AND CHOROID, DISORDERS OF.—The iris, ciliary body, and choroid, constituting the "uveal tract,"—the vascular or nutritive coat of the eye,—are best considered together.

The inflammations and degenerations that commonly affect the uveal tract are especially dependent on constitutional conditions.

Anomalies of the Iris and Choroid.—ALBINISM.—Absence of pigment in the uveal tract accompanies the lack of pigment in the hair and skin throughout the body. The iris has a dull, gray-blue color, the pupil by ordinary illumination may appear red. With the ophthalmoscope, red fundus-reflex may be seen through the iris, and the choroidal vessels are distinctly visible against the yellowish-white background of the sclera. Such eyes usually present high errors of refraction, for which correcting lenses should be worn.

Instance of partial albinism of the iris in a man, 57 years old, who showed evidences of an anterior chorioretinitis complicating a peripapillary choroiditis. By focal illumination the iris presented a uniform coloration: its anterior layers were normal, and there were no signs of pathological change. When light was thrown into the eye, however, by the mirror of the ophthalmoscope, the inferior half of the iris permitted the rays to pass through its meshes. Thought to be due to congenital lack of development. Dujardin (Jour. des Sciences Méd. de Lille, Jan. 6, '93).

Light irides held to be a variety of albinism, an arrest of development of the pigment-granules, arising from an imperfect nutrition of the anterior section of the eye. Malgot (Rec. d'Ophtal., Aug., '95).

ANIRIDIA is complete absence of the iris.

Instance of traumatic aniridia where the iris had slipped under the conjunctiva through a rupture in the sclera. By reason of the malposition of the iris it was possible to see the ciliary processes elongate under the use of eserine. The visual field was not larger than normal. Wintersteiner (Inter. klin. Rundschau, Aug. 23, '93).

Case of traumatic aniridia: no inconvenience save from excessive light. René (Gaz. des Hôp., Oct. 9, '94).

Case of traumatic aniridia with conservation of lens. Ahlstroem (Beiträge z. Augenh., vol. xvi, '94).

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Partial aniridia and corectopia (slit-shaped pupil) represent a non-development of the arteries which, springing out into the anterior chamber from the major circle of the iris, collect about them the tissue that makes up the iris-stroma. W. C. Posey (Arch. of Ophth., July, '97).

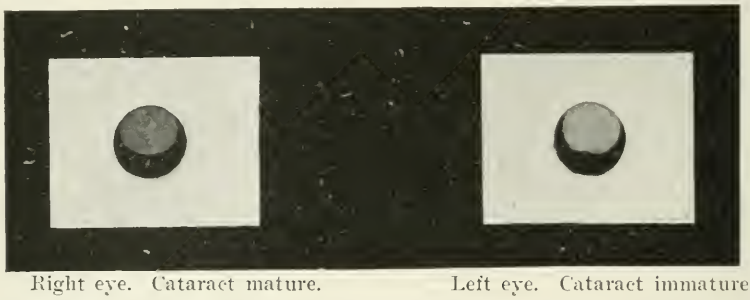
Cause of congenital irideremia is lack (usually hereditary) of sufficient formative material for the development of the eye. Matthias Lanckton Foster (Archives of Ophth., Nov., '98).

Congenital aniridia indicates a strong tendency to hereditary transmission. While focal illumination may not reveal any trace of iris, the microscope has shown that there is always a rudimentary iris present. The cornea is generally full sized, but may be smaller than normal. The cornea may be clear, but in most instances shows some pathological change. There may be anterior or posterior polar or lamellar cataract: and the lens is frequently displaced. The lens may remain clear for some time, but some form of

cataract will generally develop before puberty. Nystagmus is present in some cases. The fundus may be normal. Changes in the choroid have frequently been observed.

In aniridia opaque lenses should be removed as soon as possible. When the lens is displaced, according to the indications of the case, either a discission or extraction is indicated. A low degree of increased tension following the discission or extraction may yield to myotics. If the tension should not yield to eserine or pilocarpine, then anterior sclerotomy must be done. Joseph Andrews (Ophthalmic Record, Nov., '98).

Coloboma of the iris is an extension of the pupil usually downward. Displacement of the pupil is called "corectopia."



Right eye. Cataract mature. Left eye. Cataract immature.

Congenital irideremia with both lenses displaced upward. Actual size of cornea and lens: Vertical diameter, 9 millimetres; horizontal diameter, 10 millimetres; distance between pupillary centres, as in above drawing, *i.e.*, 61 millimetres. (*Andrews.*)

Case of congenital double corectopia, in a man aged 45. The pupils were situated above and in: the right had the form of a rectangle, rounded at the angles, and the left was slit-like in character. There was also luxation of both lenses, and an atrophic retinochoroiditis. The patient had light-perception in the right eye. There were no other malformations. Fromaget (Jour. de Méd. de Bordeaux, Dec. 6, '91).

Corneal reflexes studied in several cases of bilateral corectopia by means of Javal's ophthalmometer. It was found that, in spite of a marked degree of eccentricity of the pupil, a part of that aperture always enters upon the corneal zone, which is more or less central and is always included during the usual ophthalmometric examination Antonelli (Annali di Ottal., vol. xxii, Nos. 2 to 5, '94).

Coloboma of the choroid is a congenital lack of choroid in some part of the fundus. Sometimes it is merely a rounded area through which the sclera is seen; sometimes it extends from the equator of the eye back to or including the optic disk. It is to be distinguished by its smooth, rounded margin from patches of choroidal atrophy, or retinal exudation.

Microscopical examination of a case of typical inferior coloboma of the iris showing a cleft in the pigment-epithelium of the ciliary process, the pars ciliaris retinæ being continuous with the coloboma of the iris. The walls of the coloboma, which were turned outward, contained no trace of the sphincter pupillæ. The connective tissue, the mesoblastic portion of the ciliary process filling the space, showed no signs of previous inflammation. In the pupillary space proper there were numerous fibres and tracts of spindle-cells extending out upon the lens-capsule (persistent pupillary membrane). The posterior capsule was normal. The cause of the non-closure of the fœtal cleft was not evident by microscopical examination. Holden (Archives of Ophthal., Oct., '92).

Persistent pupillary membrane, the remains of the fibro-vascular mem-

brane which closes the pupil during early fœtal life, appears as one or more threads that stretch across the pupil, or from the iris to an opaque area of the lens-capsule within the pupil. They are distinguished from posterior synechiæ by the fact that they arise not from the margin of the pupil, but from the front of the iris at some little distance from the pupillary margin.

Polycoria, multiple pupils, may be caused by division of the normal pupil into two by a band of persistent pupillary membrane, or it may be from openings in other parts of the iris. Only the central or true pupil is furnished with a sphincter muscle.

Iritis; Cyclitis; Iridocyclitis.

Plastic inflammation of the iris and ciliary body includes iritis, cyclitis, iridocyclitis, parenchymatous and serous iritis, and the varieties of iritis named syphilitic, rheumatic, etc., according to the supposed cause.

Symptoms.—Pain in and about the eye becoming severe, worse at night, and preventing sleep, is rarely absent. Redness is seen in the pericorneal zone; and the color of the iris is altered and the pupil contracted by hyperæmia. The iris is thickened and its surface dull. Vision is impaired by haziness of the media, plastic exudate causes the iris to adhere to the anterior capsule of the lens, posterior synechia. When the ciliary body is much involved, dots of exudate are deposited on the posterior surface of the cornea, usually on a triangular area at the lower part, "keratitis punctata"; and the ciliary region is tender to touch.

The incipient symptoms of syphilitic iritis are generally very insidious, and consist in subjective sensations of light rather than failure of visual power. Almost every part of the eye is more or less affected. The retinitis may be monolateral. Hirschberg (Deutsche med. Woch., Oct. 25, '88).

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The cornea is affected in every case of iritis. In no case does it retain its perfect transparency. The opacities consist of deposits upon Descemet's membrane and infiltrations in the substantia propria. It is these deposits which cause the pupil and iris to appear blurred and hazy, and which are often referred to as muddiness of the aqueous humor. Friedenwald (Arch. of Ophth., Apr., '96).

Two cases of painful iritis. In both the only sign of iritis was a slight sluggishness of the pupil. There was almost no injection, and what was present was not characteristic. In the first case synechiæ were found and the pupil was irregular. In the second the whole pupillary border was adherent to the lens. Walker (Phila. Polyclinic, Jan. 9, '97).

The synechiæ prevent the dilatation of the pupil under a mydriatic, which therefore becomes irregular in shape. In a few cases general adhesion of the iris to the lens occurs without much pain or redness of the eye.

Etiology.—Iritis may be caused by traumatism, but usually arises from some dyscrasia. Half of all cases are due to syphilis; other causes in the order of their frequency are rheumatism, anæmia, acute febrile diseases, diabetes, gonorrhœa, gout, and new growths in the iris. In syphilis it occurs in the secondary stage within a year after infection. With rheumatism it may occur with or between other manifestations of the disease. It arises during convalescence from acute fevers.

Curious case of grave iritis, evoked by the hairs of a caterpillar, which had penetrated into the interior of the eye. Weiss (Archiv f. Augenh., Aug., '89).

Case in which a stone splinter remained in the iris for thirty-one or thirty-two years without causing any inflammatory reaction. Rieke (Zehender's klin. Monats. f. Augenh., Sept., '90).

Case of successful extraction of a piece of steel from an iris in which a plastic inflammation had been established, with

prompt subsidence of the inflammatory reaction and restoration of full vision. Heckel (Bull. de la Soc. de Méd. de Rouen, Oct., '95).

Catheterization of the urethra followed by an abscess of a testicle. Six months later, after catheterization, patient had a chill and fever, and in twelve days a purulent iritis. The inflammation increased and in a short time the ball was filled with pus. Starting from the iris, the infection spread to every structure of the eye. Inflammation attributed to a lodgment of microbes. Trousseau (Ann. d'Oculist., Mar., '94).

The various forms of iritis are all infectious. Where the condition occurs as a result of syphilis, etc., it may be regarded as an attempt at elimination by the gland (the uveal tract being considered as such). Lapersonne (Le Bull. Méd., Feb. 21, '92).

Three cases of iritis hæmorrhagica, in which the anterior chamber was filled with blood, which was finally totally absorbed. In all three there was a distinct rheumatic history. Reche (Zehender's klin. Monats. f. Augenh., May, '92).

Case of recurrent iritis occurring in a young woman who was subject to attacks of subacute rheumatism. The ocular symptoms yielded to salicylic acid. Foltz (Chicago Med. Times, Dec., '93).

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Of 670 cases of iritis seen, but 1 was rheumatic in nature. (Calcutta Ophthalmic Hospital Reports; Centralb. f. prakt. Augenh., Apr., '96.)

The flattening of the cornea against the iris by too firm pressure may set up iritis. Jocqs (Le Bull. Méd., Mar. 8, '96).

Most forms of iridocyclitis result from the action of micro-organisms. Sydney Stephenson (Lancet, Feb. 29, '96).

Most inflammatory affections of the iris and ciliary body are the outcome of constitutional ailments, which are in turn due to microbic infection. In certain forms of iridocyclitis specific micro-organisms have been found in the anterior chamber. There exist good grounds for believing the proximate cause of all cases of endogenous iridocyclitis to be the excretion by the ciliary body of micro-organisms or their products. Therefore bacteriological examination of the aqueous humor might furnish a ready means of detecting an organism in those maladies thought to be of infectious nature, such as rheumatism. It might also lead to a correct conclusion as to the cause of doubtful cases of iridocyclitis. Stephenson (Lancet, Feb. 29, '96).

Diagnosis.—Iritis and cyclitis nearly always co-exist. Iritis may be considered absent if there is no visible alteration of the iris and the pupil dilates widely and evenly under a mydriatic. Cyclitis is absent if there be no deposit on the cornea, or haziness of the vitreous, or tenderness of the ciliary region. Iritis and cyclitis must be distinguished from keratitis by absence of change in the cornea; from glaucoma of the contracted pupil, and the absence of dilated scleral veins, increased tension or cupping of the optic disk; from panophthalmitis by the absence of swelling of the lids and dense opacity of the vitreous; from neuralgia by the redness of the eye and the alteration of the iris; from conjunctivitis by the slight swelling and freedom from discharge of the conjunctiva. The alterations in the pupil are best seen with the ophthalmoscope or after the use of a mydriatic.

Study of the manifestations of syphilis in the ciliary body. Conclusions: 1. Whenever syphilitic iritis is accompanied by a punctate keratitis, either chronic or recent, areas of atrophic choroiditis will be found in the ora serrata. 2. In parenchymatous interstitial keratitis, when due to hereditary syphilis, disseminated plaques, which sometimes reach to the posterior segment, are seen in the ora serrata; more often, however, they are confined to the ciliary region. 3. Diffuse syphilitic choroiditis with disease of the vitreous always presents atrophic alterations of the ora serrata, and the opacities of that humor are due to this latter lesion. 4. In ataxic atrophy of the disks atrophic and pigment changes occur in

the ora serrata. 5. In syphilitic inflammation of the cerebral or cerebro-spinal nerves characteristic signs of the disease appear in the ora serrata. Galezowski (Gazette des Hôp., Apr. 18, '94).

1. It is important, from a clinical point of view, to differentiate a tubercular variety of iritis. 2. This form of inflammation is premonitory of the tubercular nodular eruption, which it may precede by several weeks. 3. It is characterized by its subacute mode of invasion; its evolution is slow and torpid, being marked by faint reactional signs, although in addition there may be dense synechiæ more or less completely obstructing the pupil. 4. The absence of pathognomonic symptoms renders the diagnosis difficult. 5. The tendency to spontaneous cure of miliary tuberculosis of the iris depends upon the individual resistance, and especially upon the resistance of the iris. The incapsulation of tubercle of the iris and the rapid obliteration of the surrounding capillaries favor its isolation and the protection of the sound tissue. It is not the attenuation of the bacillus nor of the toxins which brings about resolution, but the character of the tissue which receives the poison. Vignes (Recueil d'Ophtal., Apr., '94).

Microscopical study of an eye with supposed tubercular iritis, in a girl, 15 years of age, without definite tubercular history. The affection began as a brown spot at the base of the iris and was followed by the appearance of other similar areas, and, later, by blindness. The growth consisted of a granulomatous-looking mass (with a few ill-defined giant-cells) situated near the base of the iris and blocking the angle of the anterior chamber. Benson (Dublin Jour. Med. Science, Jan., '95).

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Painless iritis, easily mistaken for less serious diseases, and readily diagnosed by the instillation of a mydriatic, is an insidious and dangerous affection, because not brought to the notice of the oculist until late in the disease, when synechiæ have formed. G. Walker (Phila. Polyclinic, Jan. 9, '97).

Importance of clearly separating from iritis of the ordinary type certain cases hitherto classified with it, but in which only the posterior layer of the iris, the uvea, is involved. These cases grouped under the term "uveitis." The two affections differ in all respects as to symptoms, course, causes, and cure.

Uveitis is observed exclusively among women; iritis is more frequent among men. Uveitis always affects both eyes: iritis often affects but one. Uveitis lasts for years, and is manifested by slight periodical exacerbations, lasting five or six days; iritis is far more violent in its manifestations, but is cured in a month or two. The usual causes of iritis are syphilis, rheumatism, and gout. These are not the causes of uveitis, whose causes are unknown. Atropine is of great value in the local treatment of iritis; but iridectomy is the only effective local treatment for uveitis.

The differential diagnosis during the attack may be made by noting that in iritis there is always marked discoloration of the anterior surface of the iris, which in uveitis is not perceptible. In iritis the pain and hyperæmia are violent: in uveitis pain is almost or quite absent and hyperæmia slight. In iritis, even apart from adhesions, the pupil dilates imperfectly with atropine; in uveitis it dilates freely, except in so far as it is bound down by old synechiæ. Grandclément (Lyon Méd., tom. xxxii, No. 34).

Prognosis and Sequelæ.—Iritis is a slow, painful, disease dangerous to the future usefulness of the eye. Eyes that do well may take many weeks to recover; and pain may continue or increase many days after efficient treatment is begun. It is liable to relapse or recur, especially in rheumatic or cachectic patients. When the whole margin of the pupil is bound down to the lens, exclusion of the pupil, the forward current of fluid from the posterior chamber is obstructed, pushes forward the iris, and causes secondary glaucoma. Extensive plastic deposits about the lens and in the vitreous are followed by softening and shrinking of the eyeball with detachment of the retina,

blindness, and degenerative changes in all parts of the eye. Few cases of iritis recover absolutely, although many eyes remain quiet and useful throughout life.

In New Orleans cases of iritis are of much shorter duration (average of eight cases 12.6 days) than at other places where the relative humidity of the atmosphere is greater. Ayres (New Orleans Med. and Surg. Jour., Aug., '88).

The only case in ophthalmic literature of vascular formation of the lens-capsule during chronic iritis. The iris had been the subject of repeated attacks of inflammation leading to extensive synechiæ. The new veins and arteries were distinctly seen ramifying on the lower outer section of the capsule. Darier (Ann. d'Oeul., Jan., '95).

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Corneal complications occuring in the course of or after plastic iritis: fine dust-like deposits upon the membrane of Descemet, large deposits similarly located (Descematitis), linear infiltration of the substantia propria, at times assuming the appearance of circumscribed sclerotizing keratitis, and in one case resembling keratitis punctata vera. Friedenwald (Arch. Otol., Apr., '96).

Serous iritis never exists without coincident cyclitis and choroiditis, and sometimes hyalitis. W. Cheatham (Ophth. Rec., Aug., '97).

Sometimes iritis causes a myopia that may last for some months.

Treatment. — The eye should be promptly put under the influence of a mydriatic, preferably atropine, which should be continued until the eye is free from redness, except, in a few cases of cyclitis without iritis, which do better with the pupil undilated. The prevention and breaking up of synechiæ by such a drug is usually of greatest importance. The eyes should be given complete rest, and protected from sudden changes of light. Dark glasses may be worn in the sunlight. The general nutrition of the patient is so important that confinement to a dark room should not be continued more than a few days. Pain may be relieved by bathing the eye with very hot water from three to five minutes several times a day; or by taking blood from the temple.

Scopolamine hydrobromate acts very energetically, often removing synechiæ which atropine had failed to influence. Quickly removes pain of iritis and other inflammations of the anterior portion of the eyeball; scarcely any unpleasant by-effects. One to 2 per 1000 strong enough for ordinary purposes. Repeat instillations three or four times a day. Raehlmann (Wiener med. Woch., No. 20, '94).

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Hydrobromate of scopolamine is of the greatest value in the local treatment of the various forms of plastic iritis.

For quick and active measures, which are so eminently necessary in incipient cases of plastic iritis, and during the early stages of inflammatory reaction, the scopolamine salt is to be preferred to the atropine; but where prolonged use of such drugs is necessary, as in many cases of the chronic form of the disease with subacute exacerbations, the alternate employment of scopolamine and atropine seems empirically to be the best method of local administration that has been devised.

The best method of instillation is by dropping the solution upon the upper corneal border while the lower punctum is everted and the corresponding canaliculus is pressed upon; and the most efficient amount to be used at one sitting is 2 drops of a $^1/_{10}$ of 1-per-cent. strength (1 to 500), repeated, if necessary, as often as three times during the course of an hour, and preceded, when desired, as in some instances where there are much irritation and pain, by 2 drops of a 2-per-cent. solution of hydrobromate of cocaine a few minutes before each instillation of the scopolamine. Oliver (Amer. Jour. Med. Sciences, Nov., '96).

The chief treatment of iritis is the use of atropine, which should be administered both early and late, and in sufficient

strength to dilate the pupil thoroughly, and at such frequent intervals as to maintain the dilatation. In the early stages the use of a solution of 4 grains to the ounce of the sulphate of atropine applied every four hours, or even more frequently, is necessary to bring about this result. Good effects from combining cocaine with the atropine in the earlier stages. After full dilatation has been obtained the cocaine may be dropped, but the use of atropine until all inflammation of the iris has disappeared is absolutely imperative. L. F. Love (Med. News, Jan. 9, '97).

Moist applications usually possess more intensity of action and are generally used, though dry heat may be more satisfactory in scleritis and iritis. W. H. Poole (Jour. of the Amer. Med. Assoc., May 14, '98).

Internally calomel should be given until the bowels are freely moved; and mercury continued by inunction or in other forms in the syphilitic cases. Whatever constitutional condition is present is to be carefully treated; and tonics used to build up the general condition.

Three cases of obstinate iritis which yielded to treatment after the correction of different nasal conditions. Septic substances from the nose and its adjoining cavities reach the uveal tract of the eye either through the lymphatics or through the blood. Ziem (Annales des Mal. de l'Oreille, du Larynx, etc., '93).

Continuous current employed in eight cases of old iritis complicated by synechiæ, currents weaker than 5 milliampères giving the most favorable results. The positive pole is placed behind the ear, while the negative one is applied upon the closed eye. Atropine is instilled at each *séance*, which should be about twenty-five minutes in length. The amelioration in vision produced by this plan of treatment is obtained (1) by bringing about partial or complete absorption of the exudates which block up the pupil; (2) by clearing up the vitreous. Bansier (Annales d'Oeul., Sept., '94).

Analysis of 105 personal cases. Acute plastic iritis, whether specific or not, is a self-limited disease; while local treatment is of the greatest value in soothing the pain and preventing adhesions, constitutional treatment will not tend to shorten the duration of the disease. Bruns (Med. News, July 20, '95).

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Marmorek's serum in small and repeated doses ($^1/_2$ a cubic centimetre daily at first, rising to 1 cubic centimetre or more) seems to arrest the rheumatic process after one of the three to six successive advances which together constitute acute rheumatic iritis. In chronic and long-standing rheumatic iritis with organized adhesions, sclerosis, or atrophy of the iris, the normal course of cyclical evolution does not occur, and the influence of any therapeutic agent is, therefore, less easy of demonstration. In cases of relapsing acute or chronic iritis, the serum produces some amelioration of the visual function. Boucheron (Gaz. Hebdom. de Méd. et de Chir., June 16, '98).

Case of violent iridocyclitis in a man who had general ciliary injection, contracted pupils, extensive posterior synechiæ, and deposits on the posterior surface of the cornea. T. + 1. V. R. $^6/_{60}$, L. $^6/_{24}$. After twenty-one hypodermic injections of $^1/_8$ grain of pilocarpine muriate, extending over seven weeks, and 60 grains of potassium iodide daily with mercury occasionally, improvement was rapid and pronounced. V. increased to R. $^6/_{24}$, L. $^6/_{15}$. There were no relapses, tension became normal, and the exudation was promptly absorbed. Six months later V. had increased to R. $^6/_9$, L. $^6/_6$ with —50°, Ax. 90°. R. R. Tybout (Columbus Med. Jour., Dec. 20, '98).

Iridectomy.—The excision of a part of the iris may be required for the sequels of iritis, as exclusion of the pupil or extensive synechia; for occlusion of the pupil, its closure by a deposit of lymph; for corneal opacity in front of the pupil, some part of the cornea remaining clear; for partial opacity of the lens; or for glaucoma.

Location.—If done to secure a clear passage for light through the dioptric media, "optical iridectomy," it must be located so light can enter through the best dioptric surfaces, must be as small as will remain subsequently unobstructed and must be exposed when the lids are opened. If it is merely to free the iris from its adhesions, or open up a passage from the posterior to the anterior chamber, or for glaucoma, it should be placed where it will ordinarily be hidden as much as possible beneath the lids. For glaucoma it should be large, including one-fifth of the circumference of the iris, and should extend up to the ciliary margin.

Technique.—An incision is made in the cornea between the location for the iridectomy and the corneal margin, slightly longer than the width of the iridectomy and parallel to the corneal margin. This is made either with a narrow Graefe knife or a lance-shaped keratome. A pair of iris-forceps is introduced and the iris seized near its pupillary margin, and the part so caught is drawn outside the corneal incision. Sometimes the iris can be better separated from adhesions by a blunt iris-hook which is pressed upon the pupillary edge of the iris until it catches under it, and draws it out through the corneal incision. A sufficient portion of the iris having been drawn out, it is cut off with fine scissors, the stump is returned within the eye, care being taken to free it entirely from the corneal incision: and the eye is closed with a light dressing until the corneal wound ceases to allow the escape of the aqueous, usually but a few hours. Iridectomy should not be done for the sequelæ of iritis until long after the eye has become free from redness or irritability.

In iridectomy instead of drawing the iris out and stretching (perhaps tearing) the fibres, so that the resultant coloboma is irregular and misplaced, two incisions four to five millimetres wide, one above and the other below, should be made. The de Wecker scissor-forceps are then introduced into the lower section, and the pointed branch is slipped beneath the iris. Incisions are now made to the right and the left, thus circumscribing the summit of a triangle. The forceps are now introduced from above, the flap is withdrawn and is cut squarely off by a third snip. In this way a large, gaping opening is formed, with the apex of the triangle directed downward. Abadie (Annales d'Ocul., June, '88).

The following operation devised for the treatment of iridodialysis from contusion: "A narrow, somewhat slanting incision was made in the cornea, near the sclero-corneal junction, with a broad needle or a very small keratome. Fine forceps are introduced, and the iris, near its detached periphery, is seized and drawn into the wound. A small portion is drawn through the wound, enough only to insure being held in position by a compress bandage, till healing has taken place. In order to more thoroughly secure its maintenance in the wound, a fine suture may be passed through the conjunctiva at the border of the wound, and the iris stitched thereto. The suture may be removed in forty-eight hours." Operation successfully performed in four cases. E. Smith (Jour. Amer. Med. Assoc., Sept. 19, '91).

Case of syphilitic iritis with gummatous formations in both irides, in which iridectomy was successfully performed after the iris-tissue had become atrophic. Myers (Va. Med. Monthly, June, '93).

In anterior synechiæ the synechiæ are cut through by means of a special blunt-pointed knife, the blade of which is curved to represent the third of a circumference and having a diameter of seven to eight millimetres. An opening less than one millimetre long is made in the cornea with a Graefe cataract-knife, parallel to the radiating fibres of the iris, care being taken to avoid wounding the iris and the lens. The synechotome is then introduced between the cornea and

the synechiæ and the latter are cut through by traction with the curved knife. Atropine and bandage complete the operation. The following are necessary conditions for the operation: 1. The synechiæ ought to be sufficiently central, that the knife may pass between the point of attachment of the iris and its great circle. 2. At the point chosen for the puncture of the cornea the anterior chamber must be deep enough to prevent a wounding of the iris or to produce an adhesion in this place. Gaupillat (Recueil d'Ophtal., June, '95).

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In order to avoid prolapse of the vitreous in iridotomy or iridectomy for occlusion of the pupil, a narrow knife should be introduced through the corneo-scleral junction and the iris incised before the counter-puncture is made in the limbus on the opposite side. Segal (Novotschen-Kask, Vestnik of Ophth., Jan., Feb., '96).

Choroiditis.

Plastic inflammation and atrophy of the choroid is more of a chronic degenerative process than an acute inflammation. It often accompanies similar inflammation of the iris and ciliary body, and is variously designated "choroiditis," "iridochoroiditis," and "choroidal atrophy."

Symptoms.—Only the appearances revealed by the ophthalmoscope are characteristic of this disease, although it may be attended with discomfort or aching in and about the eyes, flashes of light, impairment of vision by scotomata, or clouds due to vitreous opacities. In the early stages of exudation the choroid may be swelled, is lighter color, yellower than normal; and may be veiled by haziness of the vitreous; but there are no pigment deposits. Later, as the process passes on to atrophy, the margins and parts included in the affected area show brown or black pigment deposits, between which may be seen the large vessels of the deep layer of the choroid or the white sclera. Throughout the disease the retinal vessels run over the affected area undisturbed. When the atrophy and pigment deposits are complete, the appearances produced tend to continue throughout life.

Etiology.—The causes of inflammation of the iris and ciliary body similarly affect the choroid. In addition, it is liable to suffer from eye-strain in hyperopia, astigmatism, and most extensively in myopia. Excessive use of the eyes and exposure to excessive light and heat, especially when habitually concentrated on one part of the choroid, are also important causes.

Two cases of gonorrhœal iridochoroiditis. In one instance the attack manifested itself on the eighth day, and in the second upon the fourth day after the appearance of the urethral discharge, subsequent to the occurrence of an arthritis. Both cases made good recoveries under the administration of large doses of salicylate of sodium and cinchonidia, potassium iodide, and appropriate local treatment. Bull (Annals of Ophth. and Otol., Apr., '93).

In specific retinochoroiditis the choroid is primarily affected, the retina secondarily, because the retinal lesions are limited to the foveal region, while those in the choroid are more disseminated. Rochon-Duvigneaud (Arch. d'Ophtal., Dec., '95).

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Two cases of suppurative iridochoroiditis caused by autoinfection. The first was seen in a man convalescent from broncho-pneumonia, accompanied by arthritis of the shoulder. The second was of puerperal origin and was associated with phlegmasia alba dolens. In both instances there was absence of pain. Despagnet (Recueil d'Ophtal., Sept., '96).

Case of double chorioretinitis in the macular regions, following a flash of lightning and a flash from burning lycopodium. The patient, a man 21 years of

age, was stunned by a stroke of lightning and upon recovering was unable to see for several moments, the sight returning first in the right eye. Later in the same day he was exposed to a flash of lycopodium powder. The following day he noticed scintillating scotomata, which persisted in greatly varying forms, together with micropsia in the right eye. In the same eye, directly in the macular region, the retinal tissue seemed to be slightly puffed into an irregular flattened mass. The tissue itself did not appear to be opaque or discolored, but glistened in places as though the underlying material was composed of an extremely-thin coating of cicatrizing, almost transparent jelly. In both eyes the nerve-head was a trifle gray and hazy. The left eye was similarly affected, though to a less degree. The visual fields were normal in extent, but exhibited a series of relative scotomata. Three months later a small hæmorrhage was visible between the choroid and retina below the left fovea. The patient made almost full recovery. Oliver (Internat. Med. Mag., Oct., '96).

Conclusions based on a study of metastatic choroiditis:—

1. Metastatic choroiditis, or suppurative panophthalmitis, may follow septic infection through the genital tract after labor.

2. As a rule, both eyes are affected, although one alone may be affected.

3. The disease first commences in the uveal tract, afterward involves the vitreous humor, and finally is exhibited in great swelling of the lids, with chemosis of the conjunctiva, and, usually, rupture of the cornea or sclera, or both.

4. The prognosis for sight is bad in all cases.

5. The prognosis for life is worse when the disease is bilateral than when it is unilateral, and is bad in all cases.

6. Endocarditis is present in the majority of cases.

7. Surgical interference is distinctly contra-indicated. J. Herbert Claiborne (Annals of Ophth., Apr., '97).

Five cases of choroiditis in young patients caused by excessive functional activity of the eyes. Diminished tonicity of the tissues and circulation incident to in-door work, vitiated air, want of sunlight, lack of exercise, and indulgence in improper food. A. C. Corr (Amer. Jour. of Ophthal., July, '98).

Varieties.—When one or two large areas of the choroid are affected at once it is called *diffuse choroiditis*. When small areas are affected the remainder of the choroid being normal, it is called *localized choroiditis* if only one or two patches appear, or *disseminated choroiditis* if there are several. When the region of the macula is involved it is called *central choroiditis*; and a form of the central occurring in old persons is called *senile*.

Senile chorioretinitis of macular region; entire fundus dotted with many yellowish-gray, round spots; larger ones in macular region. Wiegmann (Zehender's klin. Monats. f. Augenh., Nov., '94).

Diagnosis.—Choroiditis is recognized with the ophthalmoscope by the color and pigmentation of the affected areas. It has to be distinguished from exudation or opaque nerve-fibres in the retina and from coloboma of the choroid.

Tuberculosis of the choroid is to be distinguished from glioma of the retina by the early appearance of inflammatory symptoms, including iritis: phenomena which are wanting in this stage in glioma. Wagenmann (Deutsche med. Woch., Oct. 1, '91).

Prognosis.—Choroidal inflammation is always serious. Its obscure, persistent causes, difficult of recognition and removal, make it generally a disease liable to continue until it has done very grave damage to the eye. It is worth every effort to permanently check its progress. Cases where it is localized and does not involve the macula are the most favorable, and may end in cure without noticeable impairment of vision.

Treatment. — Complete rest for the eyes, often under a mydriatic, is important, with protection from sudden changes or great excess of light, or ex-

posure to heat. This will sometimes require a change of occupation, as the giving up of cooking or blacksmithing. Correcting lenses must be constantly worn, and during the acute stage much use of near vision should be avoided. The underlying dyscrasia must also receive efficient treatment, for upon this will depend the persistence and extension of the disease and the ultimate results. Syphilis should be combated by the prolonged use of mercury; with, sometimes, iodides late in the disease. A general tonic regimen is generally required. Outdoor life is beneficial, and on account of its depressing influence upon general nutrition prolonged confinement to a dark room should be carefully avoided.

Improvement obtained in a case of specific choroiditis by the application of mercurial inunction. The patient had a marked intolerance for potassium iodide and the bichloride of mercury. Micleso (Bull. de la Soc. des Méd. et Nat. de Jassy, '92).

An instance of acute, central, exudative chorioretinitis in which sight rapidly improved upon the subconjunctival injection of mercury after inunctions of the same drug had failed. Scheidemann (Centralb. f. prak. Augenh., Sept., '93).

Case of central choroiditis, in which vision was nearly lost, cured by the use of subconjunctival injections of bichloride of mercury. Inunctions of mercury and the iodides had been used without avail. Darier (Annales d'Oeul., Mar., '93).

Case of suppurative iridochoroiditis; recovery by subconjunctival injections of bichloride, mercurial inunctions, and injections of bichloride, with atropine and hot compresses. Coppez (Revue Gén. d'Ophtal., Sept. 30, '95).

Case of choroiditis of several months' duration in which, notwithstanding the use of iodide of potassium, etc., vision was reduced to light-perception. Gradual improvement occurred under the hypodermic use of pilocarpine in doses of from $^1/_6$ to $^1/_2$ grain. Fryer (Kansas City Med. Index, '92).

Case of metastatic exudative mucopurulent chorioretinitis, with complications following remittent fever, studied in which the fellow-eye showed symptoms of sympathetic irritation. Removal of the exciting eye was followed by complete recovery of the sympathizing one. Schwartzschild believes that the sympathetic affection was caused by the traction of the inflammatory exudate upon the ciliary processes, and that the disease is a neurosis of reflex origin. Weber and Schwartzschild (Amer. Jour. of Ophthal., Apr., '93).

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Conclusions regarding the treatment of choroiditis: 1. The subcutaneous injections of iodine are more efficacious than other iodized preparations in the affections of the uveal tract amenable to this treatment. 2. Such affections are disseminated choroiditis, fibrinous iridochoroiditis, and iridosclerochoroiditis. In the last two they should be joined with the usual remedies, particularly cauterization. 3. The injections are especially valuable in choroiditis of rheumatic and of bacillary origin. 4. In specific forms they are no better than iodides, and are inferior to mercury. 5. The daily doses vary from 0.1 to 0.4 centigramme: the reaction is insignificant. Vignes (Archives d'Ophtal., Aug., '96).

Purulent Inflammation of the Iris, Ciliary Body, and Choroid.—Although in grave plastic iritis hypopyon may appear, the exudate becoming largely purulent, these cases running the general course of plastic iritis require no separate consideration. A totally distinct clinical picture is presented when general suppuration of the uveal tract occurs, called "suppurative choroiditis," or "iridochoroiditis," or, from its involvement of all parts of the eye, "panophthalmitis.

Symptoms.—The disease begins with great disturbance of vision, pain in and about the eye, and general redness. The conjunctiva, the lids, and often the tis-

sues of the orbit become greatly swelled. Haziness of the vitreous quickly prevents any view of the fundus; and the eye rapidly becomes entirely blind. The pain continues to increase until the sclero-corneal coat is perforated, allowing exit to the contained pus. Then pain rapidly diminishes, the swelling goes down and the eyeball soon shrinks to a small, sightless, and generally harmless stump: *phthisis bulbi*.

Etiology.—Suppuration of the uveal tract arises from infected wounds, either accidental or operative; from perforating ulcer or abscess of the cornea; or thrombosis of the orbital veins in orbital cellulitis. It may also be produced by metastasis or embolism in connection with abscess in other parts of the body, or in pyæmic conditions, puerperal sepsis, or erysipelas, or in cerebro-spinal meningitis, influenza, scarlatina, and other acute specific fevers.

Diagnosis.—The disease cannot escape notice unless masked by previous inflammation of the orbit, erysipelas of the lids, or suppuration of the cornea; or unless it occur in the course of exhausting disease, when the local reaction may be slight, and the loss of vision unnoticed by the dull or unconscious patient. It is to be distinguished from other ocular inflammations, by the opacity of the vitreous and rapid loss of sight; or when it supervenes upon corneal ulcer, by increase of pain and swelling.

Prognosis.—Most cases run a rapid course to complete blindness and *phthisis bulbi*. In a few the reaction is less severe and a purulent accumulation in the vitreous simulating in appearance glioma of the retina remains indefinitely. Such cases are called "pseudoglioma." In a very few cases in children, where the purulent choroiditis follows specific fevers, and especially cerebro-spinal meningitis, some sight is retained, and the vitreous humor may subsequently clear up to a considerable extent.

> Intensely acute inflammation of the whole uveal tract seen in both eyes of an apparently perfectly healthy child of 6 years. The onset resembled that of acute glaucoma. Complete blindness was produced in thirty-six hours. Though the exudates had been reabsorbed in six weeks, it was not until fourteen months later that vision was found to be completely restored. Brandenburg (Archiv f. Augenh., Aug., '90).

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> Case of metastatic iridochoroiditis ending in panophthalmitis in a 9-month-old infant. Rupture of the globe finally ensued. R. S. Randolph (Ann. Ophth. and Otol., Oct., '96).

Treatment.—Pain is most promptly relieved and the disease cut short by enucleation of the eye; but this has in a few cases been followed by death from meningitis. Some authors believe that the risk of meningitis is increased by enucleation; but this is very doubtful if proper care is taken to cleanse the wound and secure free drainage.

> To prevent dissemination to the meninges, early operation is considered essential in the insidious forms of panophthalmitis. Du Gourlay (Annales d'Ocul., Oct., '92).

When, because of the patient's condition or disinclination, enucleation cannot be done, the eye should be poulticed, and after two or three days opened by a free incision across the cornea that will permit the escape of the crystalline lens and all purulent accumulations. Analgesics, such as morphine and acetanilid, may be necessary until the eye is opened. If the eye retains some sight, poulticing is improper; rest, atropine, and bleeding from the temple are indicated. Even where the eye is blind, but the pain and

swelling not severe, as in pseudoglioma, it may be wise to defer operation until the general health is improved.

Tumors of the Uveal Tract.—This is a not very unusual seat of secondary tumors, although they may attract little attention, appearing late and growing slowly. The following are the principal primary new growths.

Cyst of the iris is apt to follow a penetrating wound in which a bit of epithelium or eyelash has been implanted on the iris. It may have the form of a serous cyst occupying a large part of the anterior chamber, or an epithelial pearl on the surface of the iris. Either form may cause secondary glaucoma. It should be excised.

Case of idiopathic cyst of the iris, which throws more light upon personal belief that they are the result of incapsulation of an iris-crypt by bands which have become thickened and enlarged by some pathological process. Schmidt-Rimpler (Archiv f. Ophthal. (Gräfe), Apr., '89).

Cyst of the iris observed to develop after the performance of an iridectomy, with removal of a cilium from the anterior chamber and the discission of a secondary cataract, in an eye which had been injured eleven years previously. Burnett (Archives of Ophthal., Apr., '92).

Case of epithelial pearl-tumor in the iris following the implantation of an eyelash into the anterior chamber. When first seen, seven months after the injury, the cilium was extracted and an unsuccessful attempt was made to remove the tumor. One year later the growth had increased in size, and the eye was enucleated on account of sympathetic irritation. The tumor, which was surrounded by pigmented iris-tissue, was found to be free from the cornea, ciliary body, and vitreous, and proved to be a cyst lined by laminated epithelium and containing an opaque white substance, composed of fat-globules and polyhedral cells. Cross and Collins (Lancet, July 15, '93).

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Case of uveal cysts of the iris in which the diagnosis was made clinically. The condition was seen in an eye with absolute glaucoma resulting from chronic non-inflammatory glaucoma in a man 40 years old. The masses, two in number, extended into the pupillary space and moved freely. The surface of each was jelly-like and quivering, producing fine creases in the cyst-wall. Microscopical examination corroborated the clinical diagnosis. Eales Birmingham and Sinclair Ipswich (Lancet, Feb. 15, '96).

Iridectomy advised for two brownish tumors protruding from behind the outer lower quadrant of both irides. The opinion given that these are uveal cysts, not secondary to malignant neoplasms, and perhaps arising from the anterior border of the ciliary body. M. W. Zimmermann (Ann. of Ophth., July, '97).

Gumma may develop in the iris, causing one or more rounded swellings, attended with iritis; or in the ciliary body, where it is also attended with inflammation, and may cause ciliary staphyloma either from its primary swelling or by thinning of the overlying sclera by absorption so that it cannot resist intraocular pressure. In the iris it usually leaves a thinned and atrophied spot through which may in some cases be seen the fundus-reflex. Active antisyphilitic treatment is indicated.

Rare case observed of gummatous iritis the result of hereditary syphilis, in a female child 7 months old. The anterior chamber was filled by an hæmorrhagic exudate, the iris being almost unrecognizable. Liebrecht (Zehender's klin. Monats. f. Augenh., May, '91).

Two cases of syphilitic gumma of the ciliary body. The tumor passed through the iris angle into the anterior chamber and invaded the iris, which was also the seat of the usual condylomata. In one case there was a perforation of the sclera and conjunctiva through which the most of the broken-down tumor-mass was evacuated. Under treatment the results

in both cases were good. Gallenga (Annal. di Ottal., xxv, 2, 3, p. 210).

Differential diagnosis of gumma and sarcoma of ciliary region: first, early iritis, vitreous opacities, perhaps diminished tension, rapid evolution, and bulging of sclera; second, slow non-inflammatory onset with glaucoma later: thorough therapeutic test to be made before enucleation. Rochon-Duvigneaud (Revue Gén. de Clin. et de Thér. Jour. des Prat., Apr. 13, '95).

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True gumma of the ciliary body that finally yielded to specific treatment witnessed two and a half years after the primary infection. In addition to the signs of syphilitic iritis, there was bulging forward of the iris adjacent to the tumor, producing different depths in the anterior chamber, gummatous growths in the iris, circumscribed discoloration and distinction of the sclera (ciliary staphyloma), and almost total loss of vision from exudation into the vitreous and the pupillary area. H. C. Highet (Brit. Med. Jour., Nov. 7, '96).

Case of unilateral syphilitic iritis, with typical gumma, occurring in a man 25 years old, three months after chancre of the lip, and preceded by roseola, mucous patches, etc. Cure was apparently obtained after a month's treatment, but a second attack was precipitated by instillation of pilocarpine. The inflammation was ultimately cured without any trace of the affection, vision being absolutely perfect six months after. Armaignac (Recueil d'Ophtal., Mar., '96).

Three cases of gumma of the ciliary body observed in patients 21, 27, and 26 years old. They appeared 2 ½ years, 6 months, and 2 years after the initial lesion. One preserved a certain degree of sight in spite of scleral perforation. In the other two the globe atrophied. Injections of calomel once a week gives the best results, but they should be combined with inunctions and with injections of the soluble salts of mercury daily. Terson (Archives d'Ophtal., July, '96).

Ossification of the choroid is often found in eyeballs that have long been blind, and have undergone extensive degenerative changes. It may cause sympathetic irritation, but not inflammation, of the fellow-eye.

Sarcoma may arise primarily in either part of the uveal tract. In the iris it appears as a tumor which grows very slowly, usually brown and deeply pigmented, sometimes of lighter color, with visible vessels.

Case of primary sarcoma of the iris, with secondary nodes in the choroid. The growth was first noticed when the patient was ten years old, and was probably congenital. When the patient was fifty-eight years old enucleation was performed, the growth having destroyed the eye. The small melanoma had developed into a sarcoma, which had infiltrated all the structures of the globe. From twenty-eight melanotic tumors of the iris, twenty-six were found malignant. Whiting (Archiv f. Augenh., Mar., '92).

The differential diagnosis with the ophthalmoscope between leucosarcoma and melanotic sarcoma can only be made either when the pigment of the hexagonal pigment-layer is absent, as in an albino, or where this layer has been broken through by the growth. Hill Griffith (Med. Chronicle, May, '92).

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Case of simple melanoma of the iris, with (associated) symptoms simulating simple non-inflammatory glaucoma. The alteration in the color of the left iris had been increasing for a period of seven years and had been accompanied by a gradual loss of vision. The melanosis had partly saturated the sclera also and its vessels. The blood-vessels of the iris were slightly enlarged, but not tortuous. There was a deep glaucomatous excavation of the nerve, and the field of vision was limited to the temporal side. Mullen (Texas Med. Jour., Nov., '96).

Primary sarcoma of the iris may be mistaken for gumma, for simple melanoma, or for primary tubercle of the iris. A simple melanoma becomes darker and darker, while a melanosarcoma ordinarily retains its primary shade. A melanoma

is also a congenital growth, while sarcoma is not. Whenever a gumma of the iris appears, there is a severe iritis, whereas in the early stage of sarcoma of the iris there are no inflammatory symptoms. In gumma of the iris there is a specific history, with other symptoms referable to syphilitic infection. The color of the gumma is either an iron-red or deep yellowish red, while that of sarcoma is reddish gray, blackish or light brown, or flesh-color (Andrews). Gumma is non-vascular and yellowish white in color at the summit, but at the base it is vascular and has a yellowish-red border (Fuchs). The administration of antisyphilitic remedies for a short time in large doses will clear up the diagnosis.

Tubercle of the iris is of much more rapid growth than sarcoma, and in color is of a light yellowish white, or light grayish white, or light grayish yellow (Andrews). As a rule, no vessels are seen on its surface, whereas in sarcoma superficial vascularization can usually be detected. The larger number of cases of tubercle have occurred in subjects under fifteen years of age, whereas the larger number of cases of sarcoma have been found in older persons. Tubercle is much more irregular in form than sarcoma, and the accompanying inflammatory symptoms also appear earlier. Clarence A. Veasey (Annal. of Ophth., Oct., '97).

Sarcoma of the ciliary body may first manifest itself in the pupil or by pushing forward the iris; or it becomes adherent to the iris and by its growth drags the iris away from its ciliary attachment, revealing the tumor beneath.

The fourth reported case of melanotic sarcoma of the ciliary body. The tumor involved the ciliary body, extending forward into the anterior chamber, and backward into the centre of the vitreous, 15 by 13.5 millimetres. It was deep brown and light gray in color, and divided by strongly pigmented septa into three small parts and one large portion. Microscopically, it presented the usual features of a mixed-cell, pigmented, choroidal sarcoma. Hirschberg and A. Birnbacher (Centralb. f. prakt. Augenh., Jan., '95).

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Case of melanosarcoma of the ciliary body observed in an early stage, associated with apparent iridodialysis. Microscopically the tumor consisted of round and spindle-shaped unpigmented cells extending from the ciliary body. Anteriorly the growth was preceded by an increase in the pigment-cells in the ciliary body, the root of the iris, and the membrane of Descemet, which gave the clinical appearance of iridodialysis. Pigment-cells were also found between the lamella of the sclera, in the blood-vessels, and even in the peribulbar tissues, showing an early metastasis. Walter (Archiv f. Augenh., B. 31, H. 11, '96).

Sarcoma of the choroid starts as a rounded displacement of the retina, which is not wavy like an ordinary detachment; and through which large vessels may be seen.

Case of melanosarcoma of the choroid with metastatic deposits, principally in the liver, and also in the mucous membrane of the bladder and duodenum, the thyroid gland, the subserous coat of the small intestine, the mediastinal, mesenteric, and inguinal glands, and the portal peripancreal glands. Hanau (Corres. f. Schweizer Aertze, Apr. 1, '91).

Case of melanotic sarcoma of the choroid and ciliary body in a man 62 years of age. Examination of the right eye showed a staphylomatous condition, with enlargement of the blood-vessels in the lower, outer quadrant of the globe. The pupil was irregularly dilated, and the iris, which was bulging, had become detached from its ciliary attachment for a distance of four millimetres in its lower, outer segment. The ophthalmoscope showed a dark, nodular mass occupying a position corresponding to the staphyloma. After enucleating the eye a piece of the optic nerve three-eighths of an inch long was excised. Examination with the microscope showed the growth to be a melanotic sarcoma of the spindle-celled variety. Seventeen months later there was no manifestation of a secondary development. Bane

(Trans. Penna. State Med. Soc., vol. xx, '90).

Two cases of choroidal sarcoma in infancy. Intra-ocular neoplasms occurring in infancy are probably sarcoma, whether their seat of origin be in the retina or in the choroid. Griffith (Rec. d'Ophtal., Sept., '95).

Case of hereditary sarcoma of the eyeball in three generations. The left eye of the mother and daughter were affected with melanotic sarcoma, and it was stated that a sister of the mother had died of multiple tumors, and had lost an eye, and that the father and a twin-sister of the first patient had also lost an eye. The nature of the affection was unknown in the last three instances. Silcock (Brit. Med. Jour., May 21, '92).

Instance of leucosarcoma of the choroid that had apparently developed from the lamina fusca. It was composed of two distinct lobes of unequal size. Microscopically, it was remarkable on account of the huge vascular spaces that permeated it in all directions. Atropine, which was dropped into the eye the better to examine that organ, probably gave rise to an increase in the arterial spaces of the tumor, rupturing and precipitating an attack of acute glaucoma, which had necessitated enucleation of the eye. Fromaget (Gaz. Hebdom. des Sci. Méd. de Bordeaux, Aug. 20, '93).

Microscopical examination of sarcoma of the choroid, arising from injury, made early in its progress, shows that the growth is almost wholly confined to the choroid. Buller (Trans. Amer. Ophthal. Soc., '95).

Choroidal tumors (sarcoma) may develop only laterally, and involve the whole uveal tract without projecting into the vitreous, and can be recognized during life only very late in their course by the formation of episcleral nodules. Mitvalsky (Arch. of Ophth., Oct., '95).

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Case of sarcoma of the choroid situated in the macular region, with propagation along the sheath of the nerve to the orbital tissue, the sclera not being perforated. The intra-ocular portion of the growth was smooth and flat, and had not produced detachment of the retina, nor had it extended farther into the globe after four years of observation. Histologically, it was composed of fusiform cells, relatively poor in vessels, but containing an abundance of pigment. The intra-orbital portion was much larger and was lobulated and incapsulated. Histologically, it was an endothelioma (or angiosarcoma), presenting cavities filled with large round cells, surrounded by a stroma of connective-tissue bundles. Many of these cells had undergone hyaline degeneration and gave the chemical reaction of glycogen. Panas (Archives d'Ophtal., Aug., '96).

From observations based upon the microscopical examination of nine cases of sarcoma of the choroid it is thought that these tumors begin in the vessel-walls and cause an obstruction to the venous circulation, which becomes greater as the vertex veins become involved. As a result of the involvement of the sclera by the tumor the lymph-channels also become blocked. In those cases in which there is greatly-increased tension the arterial lumen is concentrically narrowed. The venous congestion and increases in capillary area produced by the venous obstruction cause an augmented transudation and œdema, especially in the ciliary body, and this is the cause of increased tension. Schlemm's canal remains nearly normal in all instances, but, in cases in which the tension remains low, the surrounding veins become enlarged. In cases of markedly-increased tension the root of the iris is forced against the posterior layer of the cornea, the choroid pressing against the sclera. The tension of the eyes is not dependent upon the size of the growth, but upon its position. Travis (Ophthalmic Record, Apr., '96).

For many months or years uveal sarcoma grows slowly, giving rise to no other symptoms; this is its first, or latent, stage. Then it causes increased tension of the eyeball and inflammation; the second, or inflammatory, stage. The third stage begins when it perforates the sclera and begins to invade neighboring tissues. It now grows rapidly. The

fourth stage begins with the extension of the disease by metastasis to other organs.

Treatment.—The earliest possible removal of the tumor is indicated. In a few cases of sarcoma of the iris this may be accomplished by iridectomy, removing the growth with the iris from which it springs. In all other cases the eye must be enucleated, and if perforation of the sclera has occurred the orbit should be emptied of its contents.

If a case of primary sarcoma in the iris be seen in the first stage of the disease, before any signs of surrounding irritation have appeared, it is best to immediately remove the growth by an iridectomy so placed as to include the tumor in the coloboma; whereas, in those cases in which the second stage has been reached, enucleation should be performed. Andrews (N. Y. Med. Jour., June 1, '89).

After-results of 23 enucleations for choroidal sarcoma. Fourteen (over 60 per cent.) were well at periods varying from three to ten years, 6 died of sarcoma of the liver, and the remaining 3 died, but less certainly from extension of the disease. Local recurrence in the orbit took place in 2 cases (8 per cent.). Griffith (Brit. Med. Jour., Sept. 12, '91).

Twenty-four cases of sarcoma of the uveal tract observed in the Göttingen University clinic. In view of the proportion of 37 1/2 per cent. of definite cures personally witnessed, the prognosis does not seem to be so unfavorable as is generally supposed. It is recommended that operation should be done as early as possible. If no recurrence is noticed within three or four years, the patient is tolerably safe; not absolutely so, however, as was shown in 1 case in which there was recurrence ten years after operation. Freudenthal (Archiv f. Ophthal. [Gräfe], Apr., '91).

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In primary sarcoma of the iris, if the growth is sufficiently small and does not extend to the extreme ciliary portion of the iris, an attempt should be made to remove it by an extremely-broad peripheral iridectomy. If the growth is so large, or is situated so near the ciliary margin of the iris that it is impossible to remove all of it by an iridectomy, or if any other portion of the eye has become secondarily involved, immediate enucleation should be performed. Clarence A. Veasey (Annals of Ophth., Oct., '97).

Tuberculosis of the iris appears in isolated gray nodules, usually small and scattered throughout the iris, occasionally as a single larger growth. In the choroid the process gives rise to yellowish rounded spots without pigment change; and not attended with symptoms that attract attention, being only discovered with the ophthalmoscope or post-mortem.

Sarcoma of the iris. (*Andrews.*)

Ocular tuberculosis is more frequent than is generally supposed. Often the iritis is assumed to be rheumatic or luetic, when careful search into the general condition of the patient and the family his-

tory would reveal the true nature of the disorder. The formation of small grayish-white nodules in the conjunctiva, cornea, or iris looked upon as a valuable diagnostic sign. Manz (Münch. med. Woch., Nov. 15, '95).

Three cases of tuberculous infection of the iris found among 40,000 eye patients. The diagnosis is a difficult one. The disease may readily be mistaken for gummatous iritis or other forms of chronic iritis. It affects children from two to eight years of age, is monocular, and is almost invariably followed by fatal tubercular meningitis. The disease begins with the usual symptoms of plastic iritis. Later, whitish-gray points are found on the posterior surface of the cornea and nodules of tubercle, always vascular, on the surface of the iris. Machek (Wien. med. Woch., June 16, '94).

Tuberculosis of the iris is a rare disease. Of 15,000 patients personally seen, only 2 had tuberculosis of the iris, both dying later of tubercular meningitis. Three forms can be differentiated: (1) tuberculous infiltration; (2) disseminated tubercles; (3) conglomerated tubercles. Of 25 cases recorded in literature, 11 died of tubercular meningitis. Removal of the affected part recommended when possible. If not possible, then enucleation is to be performed. If other organs are affected, expectant treatment alone is indicated. Machek (Przeglad Lekarski, Nos. 11 and 12, '91).

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Sunlight attenuates tuberculosis of the iris and makes it benign. Baraquier (La Sem. Méd., May 9, '96).

Tubercle of the iris, the size of a pea, removed. Six months later the eye had a vision of one-half of normal. Terson (La Sem. Méd., May 9, '96).

In tubercle of the iris partial removal should be tried, whenever it is possible. De Wecker (La Sem. Méd., May 9, '96).

Tubercle of the iris may be confounded with primary sarcoma or with syphilitic gumma of the iris. Tubercle is of more rapid growth than a sarcoma, the color of the latter in the iris being reddish gray, blackish, light brown, or flesh-color. It occurs between the ages of twenty-four and sixty, while tubercle is usually found between the fourth and twenty-first year. The color of gumma is either an iron-red or a deep-yellowish red. It is always accompanied by considerable reaction and generally by other signs of syphilitic infection. J. A. Andrews (Inter. Med. Mag., Aug., '97).

EDWARD JACKSON,
Denver.

IRON.—Iron, or ferrum, U. S. P., as described by the pharmacopœia, occurs in the pure form of fine, bright, non-elastic wire. From this all official preparations should be made. The official preparations of iron may be arranged in four groups: first, the bland, or those devoid of striking physiological effects, and which may be subdivided into two classes, those soluble in water and those insoluble in water; second, the astringent; third, the compound, in which another active medicinal agent enters into combination with the iron: and fourth, other official preparations which include those preparations which are seldom used internally or are used for effects other than those properly belonging to iron. A fifth group may be added, embracing some of the non-official preparations of iron which have been found useful and worthy of record. The iron compounds are also known as chalybeates, or martial preparations. Mineral springs containing iron furnish the so-called chalybeate waters.

Preparations and Doses.

I. BLAND PREPARATIONS.

(*a*) *Soluble in Water.*—Ferri carbonas saccharatus, 2 to 10 grains.

Liquor ferri citratis, 5 to 15 minims.

Ferri citras, 5 to 15 grains.

Ferri et quininæ citras, 3 to 10 grains.

Ferri et quininæ citras solubilis, 3 to 10 grains.

Vinum ferri amarum, 1 to 3 drachms.

Ferri et ammonii citras, 5 to 15 grains.

Ferri et strychninæ citras, 1 to 5 grains.

Vinum ferri citratis, 1 to 2 drachms.

Ferri et ammonii tartras, 10 to 30 grains.

Ferri et potassii tartras, 10 to 30 grains.

Ferri hypophosphis, 5 to 10 grains.

Ferri lactas, 1 to 5 grains.

Syr. hypophosphitum cum ferro, $^1/_2$ to 1 $^1/_2$ drachms.

Ferri phosphas solubilis, 5 to 10 grains.

Syr. ferri quin. et strychninæ phosphatum, $^1/_2$ to 1 drachm.

Ferri pyrophosphas solubilis, 2 to 5 grains.

(*b*) *Insoluble in Water.*

Ferrum reductum, 1 to 5 grains.

Pilulæ ferri carbonatis, 2 to 5 pills.

Mistura ferri composita, $^1/_2$ to 2 ounces.

Ferri oxidum hydratum, 1 to 4 drachms.

Trochesci ferri, 1 to 6 troches.

Emplastrum ferri.

Ferri valerianas, $^1/_2$ to 2 grains.

II. Astringent Preparations.—Liquor ferri acetatis, 2 to 10 minims.

Tinctura ferri chloridi, 5 to 20 minims.

Liquor f. et ammonii acetatis, 2 to 8 drachms.

Liquor ferri nitratis, 5 to 15 minims.

Ferri sulphas, 1 to 5 grains.

Ferri sulphas exsiccatus, $^1/_2$ to 3 grains.

Pilulæ aloës et ferri, 1 to 3 pills.

Ferri sulphas granulatus, 1 to 5 grains.

Ferri et ammonii sulphas, 5 to 15 grains.

III. Compound Preparations.—Ferri iodidum saccharatum, 5 to 15 grains.

Pilulæ ferri iodidi, 1 to 3 pills.

Syrupus ferri iodidi, 10 to 30 minims.

IV. Other Official Preparations.—Ferri chloridum, styptic.

Liquor ferri chloridi, styptic.

Liquor ferri subsulphatis, styptic.

Liquor ferri tersulphatis—pharmacy.

Ferri oxidum hydratum cum magnesia: antidote to arsenic.

V. Non-official Preparations.—Ferratin, 8 to 30 grains.

Ferri arsenas, $^1/_{16}$ to $^1/_6$ grain.

Ferri bromidum, 5 to 20 grains.

Syrupus ferri bromidi, 15 to 60 drops.

Ferropyrin, 8 to 15 grains.

Hæmalbumin, 5 to 15 grains.

Hæmoferrum, 3 grains.

Hæmogallol, 2 to 8 grains.

Hæmoglobin, 75 to 150 grains.

Hæmol, 2 to 8 grains.

Liquor mangano-ferri peptonatus, 2 to 4 drachms.

Physiological Action.—The experiments on the administration of inorganic compounds of iron to guinea-pigs and other animals, according to A. B. Macallum, have resulted in showing that the intestinal mucosa absorbs these to an extent which varies with the nature of the compound and with the quantity of it given. When the dose is small, absorption occurs only in that part of the intestine adjacent to the pylorus, and measuring only a few inches in length; yet, when the quantity given at any time is large, the absorptive area may embrace the whole of the small intestine. In the former case the result appears to depend on the complete precipitation, as hydroxide, of the iron of the salt unabsorbed, in the thoroughly-mixed chyme, bile, and pancreatic juice: and, in the latter case, the large amount of the iron salt, apparently, first destroys the alkalinity of these fluids, the excess of the salt unaffected and remaining in resolution then undergoing absorption. The intestinal epithelial cells transfer the absorbed iron at once to the underlying elements when the quantity absorbed is small, but with a large amount absorbed the epithelial cells are found to contain some of it.

Though some of the subepithelial leucocytes of the villi appear to carry part of the absorbed iron into the general blood-circulation, probably the more important agent in the transference of the inorganic iron from the villi to other parts of the body is the blood-plasma. Marfori's albuminate and the commercial "peptonate" of iron, when administered to guinea-pigs, seem to stimulate the leucocytes to invade the epithelial layer of the intestinal villi. Of the organic iron compounds belonging to the "chromatin" class, that present in egg-yelk (hæmatogen of Bunge) undergoes absorption in the intestine of the guinea-pig and of the *Amblystoma*. In these, but more especially in the latter, after they are fed with egg-yelk for several days, the cytoplasm of the liver-cells yields marked evidence of the presence of an organic iron compound belonging to the "chromatin" class, and derived from the yelk fed. The mode of absorption of yelk "chromatin" is obscure, but the process appears, in some way, to be connected with the absorption of the fat with which the iron compound is closely associated in yelk.

From carefully-conducted laboratory-experiments, Gaule recently ascertained that not only the organic, but also the inorganic salts, as the chloride, are absorbed. The chloride is absorbed, since, with the organic substances in the stomach, it is changed to an organic substance. Absorption takes place almost exclusively in the duodenum, although in the stomach and small intestine it can be shown to take place. It may also take place through the intestinal epithelium and through the central vessels of the cells; also in similar manner as the fats. Two hours after the entrance of the iron preparation into the intestine there can already be shown in the pulp-cells of the spleen an increased deposition of the so-called iron-reserve. The progress of the iron-absorption is completely normal, and does not result from a disturbance of the normal activity.

The amount of iron excreted by the liver, according to Dastre, is quite variable, but the mean percentage is 0.94 of the dry residue, the hepatic iron depending more on the blood-formation or blood-destruction in the liver than on the alimentary conditions. A dog weighing 55 pounds, eliminates by the bile, in twenty-four hours, 2 $^1/_2$ pounds of body-weight.

> Iron, even in large doses, does not diminish intestinal decomposition, and its action is limited to its combination with sulphuretted hydrogen, which can then no longer exercise any influence upon the ferric constituents of the food. G. Th. Morner (Wratsch, No. 23, '93).
>
> Iron taken by the mouth is, after absorption by the intestinal canal, carried to the liver. During its passage it combines with albumin to form a compound which is deposited in the liver—perhaps more than one compound. In this organ it undergoes changes which fit it for the production of hæmoglobin. H. W. F. C. Woltering (Zeits. f. Phys. Chem., '95).
>
> The liver is especially rich in iron in pernicious anæmia. Stühlen (Deutsch. Arch. f. klin. Med., p. 248, '95).
>
> Ferric chloride is transformed in the alimentary canal first into ferrous chloride, which combines with albumin to form a soluble product by which the iron is absorbed. Cervello (Archivio Ital. de Biol., xxv, 3).
>
> Microchemical researches on guinea-pigs and other animals showing, by the ammonium-sulphide and bichromate-of-potassium tests, the presence in the intestinal villi and other tissues of an increased amount of iron after ingestion of salts of this metal and organic compounds containing it. Macallum (Jour. of Physiology, '94).
>
> It is very improbable that iron in the form of inorganic salts introduced into the human body by the food becomes

converted into hæmoglobin by synthesis. The case is otherwise with organic ferruginous combinations such as are present in the yelk of egg in the form of nucleoalbumins, from which the hæmatogen originates. Several combinations of iron exist in milk and also in vegetables, the latter containing a considerable amount, but milk only a small quantity. Perhaps the appearance of chlorosis is caused by the fact that the solid tissues of a woman abstract iron from the blood without giving anything in return. This compensation can only be effected by means of organic preparations of iron, which alone are absorbed.

Ferruginous drugs only act by suggestion,—the iron which is to be assimilated must be obtained from the market-garden, and not from the pharmacy. Bunge (Lancet, Apr. 20, '95).

Bunge's hypothesis criticised. The startling conclusion that the results of the treatment by iron must be referred to the domain of suggestion, and that a diet rich in iron, particularly meats, eggs, spinach, etc., should be substituted for the usual method of administration refuted. Reinert (Wien. med. Blatt., Apr. 25, '95).

Death-blow given to Bunge's theory, that inorganic salts of iron only cause indirectly an accumulation of iron in the liver by uniting with the H_2S in the alimentary canal, and thus "sheltering" the organic iron of the food and permitting its absorption, for, when $FeSO_4$ is given to rabbits, iron accumulates in the liver, but not when salts of manganese, which equally unite with H_2S, are substituted. Woltering (Zeit. f. Physiol. Chem., xxi. p. 186).

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When iron in the form of carniferrin is taken, it is absorbed by the epithelial cells in the duodenum alone, because in passage of the intestinal contents, further on, it is converted into an insoluble form by the SH_2 and the products of decomposition. It passes into the system in a manner which cannot be clearly explained. In or after its passage inward through the epithelial cells of the duodenum it becomes more intimately combined with organic matter, forming a compound in which, as in hæmoglobin, it cannot be detected by ordinary microchemical methods. It reaches the system through the vena porta. Part of the absorbed iron is converted into hæmoglobin; the excess which is not required for organic vital processes is stored up, first in the spleen and then in the liver. W. S. Hall (Arch. f. Anat. u. Phys.; Phys. Abtheil., '96).

An iron albuminate passes in a soluble condition into the epithelial cells of the duodenum, and is precipitated in them in the form of granules. It then passes into the central part of the villi and into the mesenteric glands by the aid of lymph-corpuscles. In part it seems to pass in solution in the blood-capillaries. The accumulation of iron in the submucous tissue of the large intestine is connected with its excretion, which is probably effected by the extrusion of iron-laden leucocytes. Hochaus and Quincke (Archiv f. exp. Path. u. Pharm., pp. 159-182, '96).

Experiments made with newborn dogs demonstrating that the presence of iron salts in the food was not immaterial to the formation of hæmoglobin, that there was no absorption of iron salts, and that the liver seemed to regulate absorption in the same way as it did glycogenesis. Cloetta (Archiv f. exper. Path. u. Pharm., '97).

The principal absorption of iron in man is in the duodenum. The iron is stored in the liver and the spleen, and is excreted by the kidney and large intestine. A. Hoffman (Virchow's Archiv, 488-512, 151, '98).

(See also ANÆMIA and ANÆMIA, PERNICIOUS.)

Results obtained in a series of experiments performed upon the lower animals shows that iron may act toxically only when it is injected into the blood or hypodermically. The action is chiefly manifested by paralysis of the central nervous system, preceded by a period of irritation. The drug produces death by asphyxia, the result of a direct action on

the respiratory centre. When the drug is administered subcutaneously for a long time, inflammatory changes are produced on the kidneys. The neutral preparations of iron do not produce symptoms of poisoning. (Wojtaszek.)

Iron administered hypodermically remains in the organism as an assimilable substance, producing hyperæmia in various organs and tissues, favoring the absorption of œdema in anæmic patients, the destruction of old red corpuscles, and the formation of new hæmatins. Rocci (Sixth Italian Congress of International Med., Rome; Univ. Med. Jour., p. 366, '95).

As to its effects on metabolism, Stockman found that the quantity of iron in the ordinary daily diet of healthy persons with good appetite averaged from $^1/_8$ to $^1/_6$ grain a day. The convalescent diet of the Edinburgh Royal Infirmary, a sufficient maintenance for persons leading a somewhat inactive life, contained $^1/_{10}$ grain a day. In the diet of a young lady, living in the ordinary way and taking an average amount of food, $^1/_8$ grain was found in the daily diet, while in that of two chlorotic girls who ate very little the quantity of iron averaged $^1/_{25}$ grain a day (four estimations).

That the iron metabolism of the body must be small is evident; the metal seems to be used over and over again. The total excreted daily by all channels is less than $^1/_{10}$ grain a day.

Less iron is excreted during the administration of iron than before. This phenomenon is attributed to the retention of the iron by the tissues, and not by the blood. After intravenous injections, a considerable amount of the metal is excreted into the intestinal tract, and, after protracted administration of iron in this manner, the largest amount is found in the liver. Iron, like other metals, accumulates in the liver. Iron is poisonous when injected into the circulation, and not so when given by the mouth, because, in the first instance, the metal does not all reach the liver at once, the part remaining in the blood acting as a deleterious agent; while, in the second instance, the iron is first absorbed by the intestines, then taken to the liver, there retained, and from there enters the system gradually. R. Gottlieb (Zeits. f. phys. Chemie, B. 15, H. 5, '91).

Experiments in regard to the influence which iron exercises over nitrogenous metabolism in the healthy body gave the following results: 1. Iron has no marked influence on nitrogenous metamorphosis in the healthy body. 2. The ingestion of iron in daily doses of 0.3 to 0.5 grain causes a very slight decrease in the assimilation of the nitrogenous portions of the food. 3. After bleeding the assimilation of nitrogenous substances increases a little whether iron is used or not, but if iron is used at this time the hæmoglobin is rapidly reproduced, and the drug would seem to be of value in restoring the bodily weight. Skvortzoff (Wratsch. No. 29, '88).

When an animal has been bled, all the organs, especially the liver, are robbed of iron to keep up the supply of hæmoglobin necessary for life. Kunkel (Arch. f. d. Gesammte Phys., '95).

The lowered amount of hæmoglobin and the histological changes of the blood depend not upon the condition of the food, but simply upon the want of iron, since with this one cannot only avoid, but also improve such conditions. Iron given in a form uncombined with organic material is taken up and assimilated by the animal organism. Cappola (Weekly Med. Review, Aug. 2, '90).

The kidney is not the means of elimination of iron. Examination of the urine is of value in elucidating the question of the normal disintegration of iron in the economy. Lapicque (Archives de Phys. Norm. et Path., No. 2, '95).

Therapeutics. — The chief indication for the exhibition of iron is the presence of anæmia, a condition in which the hæmoglobin of the blood is present in a less amount than normal. The opposite condition, or plethora, is a contra-indica-

tion. The hæmoglobin may be deficient in quantity either from defective or deficient hæmogenesis (formation of blood) or by reason of excessive hæmolysis (destruction or breaking up of the red blood-corpuscles). The best results with iron are obtained in cases belonging to the former class. Since anæmia may be due to various causes,—an insufficient food-supply, an excessive drain or blood-waste from chronic affections, scrofula, tuberculosis, syphilis, or suppurating abscess and other exhausting discharges, or from repeated hæmorrhages, or from the continued action of certain poisons, such as mercury and lead,—it follows that these causes may be grouped into two classes: removable and permanent. In the former class we may expect the best results from ferruginous medication.

There is, notwithstanding the conflicting theories, no reasonable doubt that a part, at least, of the beneficial effect of iron in anæmia is due to its local action upon the digestive organs and especially the stomach.

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In cases in which the gastric contents are already too acid during digestion iron accentuates the hyperacidity of the gastric juice and aggravates the dyspeptic symptoms which are usually present in anæmia and chlorosis. In these cases the digestive affection must be set right before iron is administered. In cases, however, in which the secretion of HCl is normal or diminished, iron may often do good service in stimulating the gastric mucous membrane to secretion. Buzdygan (Wien. klin. Woch., No. 31, '97).

There are two indications in the treatment of anæmia: to furnish needed material to the blood and to increase primary assimilation of food. The first indication is met with small doses (1 or 2 grains) of reduced iron or of the carbonate; as it has been estimated that the total amount of iron contained in the normal human blood of an adult is only about 39 grains, a large amount cannot be taken up and assimilated by that fluid. Clinical experience has shown that the second indication is best met by the exhibition of the astringent preparations, as the sulphate and chloride, and of these we find that large doses act more certainly and quickly in many cases of anæmia, especially when the tongue is broad, flabby, white (from pallor), and indented on the sides by contact with the teeth. The sulphate is one of the best preparations to increase the appetite and improve the digestion, unless the stomach proves intolerant. When feeble digestion is combined with sluggish intestinal action the addition of aloes as in the pil. aloë et ferri is recommended. Squire's "mist. ferri laxans" also contains a laxative tending to antagonize these untoward conditions:—

℞ Iron sulphate, 2 grains.
Magnesia sulphate, 1 drachm.
Dilute sulphuric acid, 3 minims.
Spirit of chloroform, 20 minims.
Peppermint-water, to make 1 ounce.—M.

Double sulphate of iron and magnesium recommended in the treatment of anæmia or chlorosis, in doses of 10 grains three times a day. It has been used with success in the following prescription:—

℞ Sulphate of iron and magnesium, 2 drachms.
Chloroform-water, enough to make 6 ounces.

Sig.: Half an ounce three times a day. Hugh Woods (Brit. Med. Jour., May 23, '91).

Three chlorides elixir, a preparation, each fluidrachm of which contains $^1/_4$ grain of protochloride of iron, $^1/_{128}$ grain of bichloride of mercury, $^1/_{250}$ of arsenic, with tincture of calisaya and aromatics, used in over 300 recorded cases of blood

diseases with satisfactory results. I. N. Love (Med. Mirror, May, '90).

Syrup of the chloride of iron, in its therapeutic properties and value, is identical with the tincture; but as a restorative agent it is more easily assimilated, and more likely to be tolerated, by the mucous membrane of weak stomachs than the old form of the chloride, while it is less harmful under prolonged use. G. W. Weld (Ther. Gaz., '92).

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If the tongue is heavily coated, the breath offensive, and the bowels constipated, the administration of iron should be prefaced by a purge. In some cases, however, even though there be no sign of digestive disorder, the stomach will not tolerate any but the blandest preparations, such as the lactate or the potassio-tartrate, which are the least constipating of the various preparations of iron. When well borne, one of the best preparations of iron is the sulphate. It is generally administered in pill form, with equal parts of potassium carbonate. Such a pill is Blaud's. In anæmia, dependent upon malarial poisoning, iron may be advantageously combined with quinine or arsenic. The citrate of iron and quinine, or the arsenate of iron—the latter in doses of $^1/_{40}$ grain, three or four times daily; the former in doses of 2 to 5 grains thrice daily—may be employed. In the anæmia, which is so common an attendant of syphilis, an excellent combination is the tincture of the chloride of iron and corrosive sublimate, as in the following prescription:—

℞ Tinct. ferri chloridi, $^1/_2$ ounce.
Hydrarg. chloridi corros., 1 grain.
Glycerinæ, $^1/_2$ ounce.
Aquæ, 3 ounces.

M. Sig.: One teaspoonful in water, thrice daily, after meals. In the anæmia of heart disease iron may be combined with digitalis. The two drugs may be given in pill form, in which case the powdered digitalis should be employed; or the tincture of the chloride of iron and the tincture of digitalis may be mingled in the same prescription. Frederick P. Henry (Med. and Surg. Reporter, Apr. 24, '97).

When the stomach rebels against inorganic iron, defibrinated bullock's blood may be given by enema or some of the organic preparations may be administered internally. In simple anæmia, ferratin, in doses of 4 to 8 grains, may be given three times daily in wafers or powder, with milk or other liquid food; children easily take half the dose. Hæmoglobin, the red coloring matter of the blood, occurs as a brownish-red powder, which may be given in doses of 25 to 50 grains, in wine or syrup, three times daily. Hæmogallol, a preparation made from hæmoglobin, may be given in doses of 4 to 8 grains, three times daily, a half-hour before meals, in powder with sugar, or in wafers, pills, or tablets. Hæmol, also from hæmoglobin, is given in the same manner as the preceding, in doses of 4 to 8 grains. Hæmoferrum is another preparation derived from bullock's blood; it is given in doses of 3 grains.

Another organic preparation that has found large use is liquor mangano-ferri peptonatus, or "pepto-mangan," a bland liquid, usually well borne by the stomach in doses of $^1/_2$ to 1 tablespoonful three times daily.

The daily amount of iron required is about 50 grains. Iron is supplied by vegetable foods of various kinds, and perhaps in sufficient quantity for the needs of a healthy person, but not enough for one suffering with anæmia. A larger quantity is furnished by animal food, particularly milk, eggs, liver, and blood. The combinations in the first three are stable, and therefore not so serviceable as those found in the last. Certain iron-containing derivatives of blood may be used with success in anæmia. Of such, hæmol and hæmogallol are particularly useful. In addition there are certain artificial products having definite value, among which is rated ferratin. Kobert (Deutsch med. Woch., July 12, 19, '94).

Ferratin tried in fifteen cases in which iron was indicated, and in which the

stomach was too irritable to tolerate the ordinary preparations. There was no digestive disturbance produced by it; it did not increase the quantity of hæmoglobin more rapidly than the other preparations of iron. Max Einhorn (Amer. Therapist, Mar., '95).

Care should be taken not to associate ferratin too closely with acid materials. Marfori (Annali di Chim. e di Farm., Feb. 1, '94).

Clinical investigations with ferratin. In anæmia following acute disease the hæmoglobin was quickly increased (over 5 per cent. in eight days), as also the number of red cells. In chlorosis the same results were visible even in a more marked degree. The general condition was improved and the increase in weight in most cases considerable. The good effects on the appetite were obvious. When compared with Blaud's pills, which also give good results, ferratin was found to lead to a greater increase in the hæmoglobin. Banholzer (Centralb. f. klin. Med., Jan. 27, '94).

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To small children ferratin is given in milk or other liquid foods, and it is found to be an excellent nourishment and one especially indicated for such children as are deprived of their mother's milk and do not thrive well on the artificial products. G. T. Richardson (N. Y. Med. Jour., Apr. 18, '96).

It is beneficial to immediately put a patient, on whom an operation has been performed, upon a course of an easily-assimilated iron preparation; peptomangan (Gude) seems to be the best form for administration. Von Ramdohr (N. Y. Med. Jour., June 26, '97).

Ferratin tried for specific blood-making effect in six cases confined in the Cagliari Clinic, and in five day-patients at their dispensary. Daily record kept of all details, including blood-corpuscle count by Thoma-Zeiss apparatus and hæmoglobin estimation by the chromocitometer of Bizzozero. From this report are quoted the conclusions:—

Case 1. December 27th, 30 per cent. hæmoglobin; red corpuscles per cubic centimetre, 3,000,000; weight, 115 pounds.

Ten weeks later, 55 per cent. hæmoglobin; 4,000,000 corpuscles; weight, 122 pounds.

Case 2. December 21st, 28 per cent. hæmoglobin; 2,800,000 corpuscles; weight, 108 pounds.

Eight weeks later, 55 per cent. hæmoglobin; 4,000,000 corpuscles; weight, 127 pounds.

Case 3. January 27th, 60 per cent. hæmoglobin; 4,000,000 corpuscles; weight, 147 pounds.

Three weeks later, 85 per cent. hæmoglobin; 5,000,000 corpuscles; weight, 154½ pounds.

Case 4. February 18th, 20 per cent. hæmoglobin; 2,000,000 corpuscles; weight, 84 pounds.

Nine weeks later, 55 per cent. hæmoglobin; 4,000,000 corpuscles; weight, 84½ pounds.

Case 5. April 2d, 45 per cent. hæmoglobin; 3,600,000 corpuscles; weight, 102½ pounds.

Ten weeks later, 65 per cent. hæmoglobin; 4,000,000 corpuscles; weight, 116½ pounds. A. Varese (Annali di Farm. e Chim., July, '98).

In chlorosis the use of iron does not yield as good or as certain results as in anæmia: in fact, some cases are not benefited at all by iron alone, but yield to a combination of iron and strychnine, or iron and arsenic.

It has been found by clinical experience that the long-continued use of iron may lead to impairment of digestion, headache, and other functional troubles. It is well, therefore, to make occasional intermissions and to give a purge meanwhile. It has also been found that good food, fresh air, and out-door exercise favor the assimilation of iron, although in some cases of profound anæmia absolute rest in bed has been found to hasten recovery.

Hypodermic Uses.—This mode of administration is especially indicated in cases of anæmia requiring rapid results and when the remedy is not well borne

by the stomach. The citrate is generally preferred for this purpose, the dose being one-half that given by the mouth.

Iron, hypodermically injected, is effective in nervous affections. Two preparations recommended: one is peptonized iron, soluble in water. A solution of this is made of the strength of 1 to 10. The second is ferrum oleatum, diluted in the proportion of 1 to 20 of olive-oil. Both preparations are employed in doses of 1 syringeful every second day. Subcutaneous iron treatment especially recommended in neurasthenic persons and in asthenic dyspepsia often associated with anæmia. No disagreeable after-effects. Rosenthal (Provincial Med. Jour., Sept., '91).

After using subcutaneous injections of iron in four cases, experimenting with both the citrate and the ammoniocitrate, it was concluded that in one case there was more rapid improvement than is usually seen when other means of medication are employed. In two cases, however, the local irritation was so severe that the injections had soon to be stopped. The solutions should be kept aseptic, and should not be used when more than eight days old. H. Birgelen (Münch. med. Woch., July 26, '91).

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Iron administered hypodermically very useful in certain forms of anæmia when a rapid effect is desired, or when iron is not tolerated by the alimentary canal. Ferrous manganese citrate, made by Merck, gives the best results. The solutions are made thus: The crystals are powdered in a mortar and gradually dissolved in hot distilled water, 1 grain of the crystals to 5 minims of water. The usual dose for an adult is 15 minims, representing 3 grains of the compound salt. The dose of iron for hypodermic use should not, to begin with, be more than one-half of what is given by the mouth. Da Costa (Ther. Gaz., May 15, '96).

In the cases where the stomach is intolerant of iron, it must be given hypodermically. The citrate of iron is as good as, if not superior to, any other preparation for the purpose. It appears in the urine half an hour after the injection, and is present for twenty-four hours, the maximum excretion taking place two to four hours after. Gloevecke and others have had good results by injecting a 10-per-cent. solution into the buttocks or muscles of the back, using 15 minims at a time. The injection causes a sharp pain, which lasts for some time, but that by using a larger quantity (38 minims) of a weaker solution (4 per cent.), this inconvenience disappears and there is only slight tenderness.

A little over 45 grains of the citrate when injected has produced vomiting, fever, and *malaise*, lasting several hours. Great caution is required if the kidneys are unsound, since even if they are healthy too concentrated injections may lead, not only to the usual harmless polyuria, but to anuria and even hæmaturia and nephritis. The treatment is altogether contra-indicated in anæmic patients suffering from hepatic cirrhosis, epistaxis, hæmorrhoids, metrorrhagia, etc., since it predisposes to hæmorrhages. Lépine (Sem. Méd., May 26, '97).

Malaria. — The anæmia of malarial poisoning is benefited by administration of iron. If the spleen is enlarged and the portal circulation engorged, a purge of compound jalap powder should precede the administration of the iron, or podophyllin should be combined with it.

The ferrocyanide of iron, or Prussian blue, possesses excellent antiperiodic properties. It is administered generally in 5-grain doses every three hours. The remedy is also a good tonic. Schussler (Chicago Med. Times, Aug., '91).

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Of five cases of malarial cachexia treated with hypodermic injections of citrate of iron, four cases recovered completely. The fifth was greatly improved. Naame (Rev. de Méd. de Paris, Mar. 10, '97).

Pseudoleukæmia. — In leucocythæmia iron is of little service, but in pseudoleucocythæmia (Hodgkin's dis-

ease, or splenic cachexia) it is highly useful.

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In series of cases of leukæmia and pernicious anæmia was I case in which the patient improved markedly under the use of arsenic and iron sulphate, the red corpuscles increasing from 886,000 to 4,360,000 during one period of the treatment. H. A. Hare (Med. News, Mar. 27, '97).

Venereal Disorders.—In the anæmia of syphilis the use of the iodide of iron is indicated.

In sloughing phagedena or chancroid, the anæmia incident to those affections is best treated by the iodide of iron, although many prefer the tartrate of iron and potash.

Twenty-five cases of spermatorrhœa treated with ferric bromide. Of this number 19 were completely cured, 2 only being unrelieved. The dose is 3 to 5 grains given either in solution or in the form of a lozenge. The ferric bromide is to be preferred to the corresponding ferrous compound. Hecquet (Ther. Gaz., Feb., '91).

Rheumatism.—Though not very often used, in acute rheumatism the tincture of the chloride in doses of 20 to 30 minims, well diluted, every four hours, will diminish the pain, fever, and sweating and lessen the danger of cardiac mischief. It will hasten convalescence and may, moreover, be used as a prophylactic against acute rheumatism in weak and cachectic subjects (Anstie), but not in the robust or full-blooded (Bartholow).

The succinate (hydrated) of iron is the most palatable preparation of iron. The tasteless succinate, in combination with an elixir, is permanent under all circumstances. Combined with syrup trifolium compound, the succinate of iron will be found without a rival in the treatment of rheumatism and the various forms of syphilis. It is similarly useful for the anæmia of chronic malarial poisoning, and is indicated in the treatment of erysipelas, pulmonary hæmorrhage, hæmorrhage of the bowels, and other intestinal disorders. It should be given in small quantities at the beginning, gradually increasing the dose. William Thornton Parker (Med. Age, Dec. 26, '91).

Erysipelas.—The treatment by iron is not new, but it is for that reason none the less satisfactory. Large doses—10 to 60 minims—of the tincture of the chloride, well diluted, may be given every four hours with advantage.

Bromide of iron believed to be one of the best preparations for internal administration, as it is easily and quickly assimilated. It is especially valuable as a topical application, in fœtid discharges and gangrenous ulcers. In erysipelas it acts as a specific. In such cases it must be freely used, painted over and beyond the infected integument. Gillespie (Pacific Record of Med. and Surg., July 15, '90).

Iron takes into the blood the oxygen required, which, coming in direct contact with the streptococci of erysipelas, causes their destruction. If iron be given all the time in this disease, and the patient placed in an aërated chamber where oxygen may be generated, the records would show a considerable decrease in mortality from erysipelas and kindred affections. J. A. Crisler (Memphis Med. Monthly, Apr., '90).

Diphtheria. — The tincture of the chloride is given internally to support the organism, either alone or combined with chlorate of potash, quinine, or strychnine. The use of the chlorate of potash in this disease is, however, objected to on the ground that it induces destructive changes in the renal tissue. Monsel's solution (liq. ferri subsulphatis) may be used locally upon the tonsils and pharynx, either pure or diluted with two or three parts of glycerin. It constringes the tissues and appears to limit the extension of the exudate. This latter application may be used in the same

manner in follicular tonsillitis with advantage.

Value of perchloride of iron in preventing the spread of diphtheria from the pharynx to the larynx. The 2-per-cent. perchloride in glycerin is given hourly, night and day, in teaspoonful or dessertspoonful doses. N. Rosenthal (Ther. Monats., Dec., '92).

Application of perchloride of iron in diphtheria made twice daily if the cases be light, and three times daily if they be serious. The drug is used either in a pure state or in one-half or one-fifth solution. The healthy adjoining tissue is not injured by the treatment. T. Huebner (Ther. Monats., Dec., '92).

Applications of pure perchloride of iron recommended in pharyngeal diphtheria. The suffering which the applications cause is most intense, but three or four are sufficient to vanquish the disease. Of thirty-six cases personally treated there was but one death: from enormous ganglionic tumefaction. Feige (Ther. Monats., July, '94).

Scrofulosis.—In scrofulous adenitis and rachitis the syrup of the iodide is beneficial. It is best to begin with small doses, gradually increasing the same as tolerance is established. The combination of the phosphates of iron and lime are preferred by some in rachitis. Cod-liver-oil given with iron increases the efficiency of the former in these cases.

Neuroses.—Neuralgia due to anæmia is greatly benefited by large doses (30 to 40 minims) of the tincture of the chloride or by 20 grains of the saccharated carbonate, given three times daily. Ferropyrin, one of the newer preparations, may be given in doses of 4 to 8 grains in these cases.

In the anæmic forms of mental diseases Bucknill and Tuke advised the administration of the tincture of the chloride of iron.

In hysteria associated with anæmia the valerianate of iron may be given in pill in doses of 1 to 5 grains, three times daily. Amenorrhœa and other derangements of the menstrual function dependent upon anæmia are benefited by the citrate of iron alone or combined with strychnine.

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A great many cases of dysmenorrhœa occur in anæmic young women, and full doses of iron will cure the anæmia and with it the dysmenorrhœa. I. Parsons (Brit. Med. Jour., Oct. 24, '96).

In epilepsy and chorea in weak and anæmic pupils the use of the bromide of iron is recommended by Da Costa, the bromide in doses of 5 to 20 grains or, preferably, the syrup of the bromide in doses of $^1/_2$ to 1 teaspoonful.

Pulmonary Disorders.—When there is anæmia the bland preparation seems to agree best. Iron is, however, contraindicated when pulmonary hæmorrhage exists or threatens and in all acute pulmonary affections.

Hectic fever is controlled by a combination of digitalis and iron: 5 drops of the tincture of digitalis may be given with 10 drops of the tincture of the chloride of iron, three or four times daily.

Cardiac Diseases. — In the various cardiac affections the administration of iron is generally beneficial. In fatty degeneration of the heart iron does good by improving the nutrition of the organ. The palpitation, murmur, and præcordial distress of anæmia and chlorosis are relieved by iron. When the cavities, especially on the right side, are dilated, and cough, dyspnœa, and dropsy are present, iron often affords greater relief than cardiac sedatives and diuretics (Bartholow). In these cases and in mitral regurgitation, as the distress is increased by the thinness of the blood, Bartholow advises the following pill, three times daily: Reduced iron, quinine sulphate, and powdered digitalis (English), of each,

1 grain; powdered squill, $^1/_2$ grain. In valvular lesions iron may be used if anæmia be present. Plethora interdicts its use.

Renal Diseases. — In this class of affections iron should be given with prudence, especially in chronic nephritis.

In chronic albuminuria the tincture of the chloride improves the digestion and counteracts the anæmia. Many prefer Basham's mixture (liquor ferri et ammonii acetatis), 2 to 4 drachms three or four times daily, on account of its diuretic action.

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There is a good deal of mischief done by iron in Bright's disease. Basham's mixture in Bright's disease was never suggested for any directly curative purpose, but simply as a remedy for the anæmia which is so conspicuous a symptom in many cases, and for this purpose it still is and always will be useful. But not every case of Bright's disease is anæmic, and as iron has no specific curative effect it is clearly not indicated in non-anæmic cases. Nay, more, it is often harmful. It may be laid down as a rule to which there is almost no exception that iron is not indicated and should not be prescribed in cases of acute Bright' disease. On the other hand, after the acute symptoms have passed away and convalescence sets in, iron is often very useful.

A second class of cases in which iron is contra-indicated is chronic interstitial nephritis, in which it is more promptly and dangerously harmful than in any other form known of Bright's disease.

The form of Bright's disease in which iron is best borne is chronic parenchymatous nephritis. And as this is apt to be associated with more or less anæmia, it becomes a most valuable remedy in overcoming this symptom. Even here the doses given are usually needlessly large. The author's practice is to determine the proper dose by an examination of the stools, and, if these are decidedly blackened, too much is being given. On the other hand, a slight coloration may be permitted. Basham's mixture is no more diuretic than the bulk of water which constitutes its menstruum. James Tyson (Jour. Amer. Med. Assoc., July 23, '98).

Hæmorrhage.—The astringent preparations of iron are useful in hæmorrhage. In the passive hæmorrhages (purpura; hæmorrhagic diathesis; gastric, intestinal and renal hæmorrhage when due to anæmia) the tincture of the chloride, taken internally, improves the tone of the vessels and the quality of the blood.

Iron-quinine chloride is exceedingly useful in cases of post-abortum hæmorrhages, in doses of 10 drops, every one or two hours, of a 10-per-cent. solution. It is likewise of value in cases of pulmonary hæmorrhage, and in profuse menstruation, in doses of 10 drops five or six times a day. J. Kersch (Pharm. Post, Mar. 1, '91).

Case of a woman, 37 years of age, suffering from aneurismal dilatation of the right carotid, who after an abortion and a tedious convalescence again became pregnant and went to full term without any specially untoward symptom. In the second week after delivery she began to show decided signs of anæmia. She was given tr. chloride of iron for weeks, but gained very little and the breast-milk lessened very much. After the use of ferratin, 15 grains daily, the improvement was decided in five days, anæmia disappearing and the supply of milk returning. S. Wolfe (N. Y. Med. Jour., Dec. 7, '95).

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Persulphate of iron, combined with inhalations of oxygen and careful hygienic regulations, most useful in treatment of hæmoglobinuria. Baccelli (Gaz. degli Osped. e delle Clin., Feb. 15, '97).

Ferratin has had a limited, but successful, trial in the New Haven Hospital. It has been used in secondary anæmias due to hæmorrhage following childbirth, etc. In primary anæmia it has been used very little. The results have usually been prompt and satisfactory. Hospital and Clinic Notes (Yale Med. Jour., June, '98).

In epistaxis and chronic coryza a weak dilution of the liquor ferri subsulphate (1 drachm to 8 ounces of water) has been advised, to be used in spray. The same application has been used in pulmonary hæmorrhage. As it stains the teeth, its use is objectionable.

Ferripyrin is a valuable styptic and astringent, having the advantage over perchloride of iron in not acting as a caustic. When applied to the mucous membrane of the nose it acts as a powerful astringent and produces a slight anæsthetic effect. It is used in the form of an 18- to 20-per-cent. solution, pledgets of cotton-wool soaked in this being applied to the bleeding-parts. For gonorrhœa injections of 1 1/2-per-cent. solution may be used. In hæmatemesis doses of 7 to 8 grains should be given. Jurasz (Ther. Monats., Feb., '95).

Ferripyrin has the same indications as perchloride of iron, with fewer objections. It appears preferable as an hæmostatic. C. Calderone (Archivio de Pharm. e Tera., Feb., '95).

Ferripyrin, a new hæmostatic, is a combination of perchloride of iron and antipyrine. It is a very fine orange-colored powder, soluble in water, the solution being deep red in color. It is intended as a substitute for perchloride of iron, and the indications for its use are the same. The dose for an adult is 7 3/4 grains internally, mixed with an oily, sweet preparation of menthol. It is of value in gastrorrhagias. For external use and as an hæmostatic, either the powder or an 18- to 20-per-cent. solution may be employed, cotton tampons being saturated in the solution and applied to the bleeding surface. In 1- and 1 1/2-per-cent. solutions it is recommended as an astringent in urethral blennorrhagia. Epistaxis in a case of nasal myoma was arrested in a very short time by the introduction of two small tampons soaked in ferripyrin. The drug is free from the caustic effects produced by perchloride of iron. L. Hedderich (Münch. med. Woch., No. 1, '95).

In hæmatemesis, 1 or 10 drops of the solution of the subsulphate, or pernitrate, well diluted in ice-water, will generally be followed by relief. The tincture of the chloride may be similarly used.

In intestinal hæmorrhage iron is less beneficial, as it becomes converted into the inert sulphide as it descends the alimentary canal.

Local Uses.—The bleedings from hæmorrhoids may be diminished, or even arrested, by bathing the protruding tumors with Monsel's solution. The tumors should be well oiled before returning them. The hæmorrhage from leech-bites and after the extraction of teeth, and the oozing from surface in minor surgical operations may be arrested by the application of Monsel's salt or solution combined with pressure, when possible. Fissured nipples may be healed by brushing the fissures with Monsel's solution diluted with three parts of glycerin. Syphilitic vegetations of the glans and prepuce will disappear under applications of pure Monsel solution; *Ascarides vermiculares* may be removed by injections of weak dilutions of the tincture, and, as anæmia is usually present in these cases, the internal use of iron is advised.

C. Sumner Witherstine,
Philadelphia.

ITCH. See Scabies.

J

JABORANDI.—Jaborandi (Pilocarpus, U. S. P.) is the dried leaflets of the South America trees *Pilocarpus sellvanus* (Rio Janeiro jaborandi) and *Pilocarpus jaborandi* (Pernambuco jaborandi), belonging to the family *Rutaceæ*. The leaflets have an aromatic odor, and an aromatic, bitter, and pungent taste. When chewed they produce an increased flow of saliva. Jaborandi contains two alkaloids (pilo-

carpine and jaborine), a volatile oil, jaboric acid, and tannin. Chemically the two alkaloids are similar. The physiological actions of the two alkaloids are widely different. The alkaloid pilocarpine is non-crystallizable, and occurs as a colorless or yellow syrupy liquid, which is soluble in water, alcohol, ether, and chloroform. The salts of pilocarpine are crystallizable. The hydrochlorate is official and occurs in white, hygroscopic crystals, of a slightly-bitter taste and of an acid reaction; it is soluble in water and alcohol, and does not keep well.

A preparation of pilocarpine previously active may suddenly lose all its power. H. Magnus (Ther. Monats., Feb., '88).

Jaborine is never used in medicine, and has an effect antagonistic to pilocarpine, or like atropine.

Preparations and Doses.—Pilocarpus, 5 to 50 grains.

Extract or extractum pilocarpi fluidum, 10 to 60 minims.

The hydrochlorate of pilocarpine (pilocarpinæ hydrochloras), $^1/_8$ to $^1/_2$ grain.

Physiological Action. — A medicinal dose of jaborandi causes flushing of the face and neck, followed by profuse sweating of the entire surface, marked salivation, and occasionally nausea. In some subjects, and particularly in children, even large doses produce no effect.

Toxic doses cause depression of the nerve-centres, but normal doses seem to slightly, if at all, influence the nervous system. The pulse of animals is slowed by jaborandi; but this does not seem to be the case in man, in which, on the contrary, the pulsations are increased in number. The temperature is markedly lowered after a rise of short duration.

Pilocarpine, according to Reichert, first increases and then decreases bodily temperature. Heat-production and heat-dissipation are first increased and then diminished. The alterations in temperature are dependent essentially upon the actions on heat-production, but may be affected by sweating, and, after very large doses, by alterations in heat-dissipation. The primary increase of temperature is due at first to an increase of heat-production, but after very large doses this increase may be exaggerated and continued by a diminution of heat-dissipation which is greater than the depression of heat-production. The actions on the process of heat-production are so much more potent in their effects on temperature than those on the sweat-glands that it is doubtful if the latter ever play an important part in the temperature-alterations. Bodily temperature may be increased during the stage of diminished heat-production, owing to the great depression of heat-dissipation. The amount of increase and decrease of temperature and the duration of each of these periods are essentially in direct relation to the dose.

Horbaczewski found that pilocarpine caused an increase in the number of leucocytes in the blood and a correlative increase in the quantity of uric acid. The excretion of urea is markedly increased.

The influence of jaborandi upon the renal system differs with the dose administered. Large doses, by diminishing the body-liquids through the profuse sweating induced, decrease the quantity of urine; small doses increase the flow.

As to the direct cause of the sweating, it is thought to depend upon stimulation of nerve-ends of the sweat-glands and upon paralysis of the vasomotor nerves, as would naturally be inferred.

Poisoning by Jaborandi or Pilocarpine.—Serious and even fatal results have followed the injection of medicinal doses of pilocarpine: $^1/_3$ grain of pilocarpine has caused profuse diaphoresis,

salivation, lacrymation, a discharge from the nose, sickness of the stomach, difficulty in breathing, and a sense of cardiac oppression. Rémy mentions a case in which the remedy induced a series of epileptic attacks. In another case the patient suddenly expired directly after an injection had been made. The use of lethal doses is usually followed by copious sweating, dizziness, salivation and swelling of the salivary glands and tonsils, lacrymation, discharge from the nose, hiccough and strangling, vomiting, diarrhœa, a tearing pain in the eyeballs, myopia, dimness of vision, strongly-contracted pupils, dyspnœa, and more or less cardiac oppression, and sometimes bloody leucorrhœa is seen. These effects and the report of occasional cases of accident following the administrations of medicinal doses should teach caution in the use of the remedy.

> Caution advised in the use of what may prove a dangerous drug, as fatal or alarming symptoms may be produced by pilocarpine. Lanphear (Kansas City Med. Index, Nov., '88).

Treatment of Poisoning by Jaborandi. —The untoward symptoms of poisoning by jaborandi indicate the use of active external and internal stimulation. If taken by the mouth, use emetics or a stomach-siphon to wash out any portion of the drug that may be present in the stomach. Atropine or any preparation of belladonna may be used as a physiological antidote. Ammonia and brandy should be given freely. The vomiting may be controlled by morphine.

Therapeutics. — The therapeutics of jaborandi accord strictly with its physiological action, for it is mainly employed for its property of producing sweating. As it is the most powerful remedy we possess for this purpose, it should be used with great caution, as it is much more depressing than the use of the hot-air bath, water packs, etc.; it should not be used in cases of asthenia or adynamia, or in pronounced embarrassment from organic diseases, pulmonary congestion or œdema, threatening or existing, or in irritation or inflammation of the alimentary canal.

Uræmia and Nephritis. — Pilocarpine is generally to be preferred to jaborandi, as it is less likely to produce nausea and vomiting.

Jaborandi and its alkaloid, pilocarpine, are agents that are extremely useful in uræmia, fever, desquamation, or chronic parenchymatous nephritis, since they markedly increase the elimination of urea by the skin; lower the blood-pressure, and diminish the inflammatory condition. In acute scarlatinal nephritis pilocarpine is of the greatest service, increasing the urinary secretion and decreasing the albumin and the blood. Shoemaker suggests the following formula:—

℞ Extract of jaborandi, $^1/_2$ fluidounce.
Solution of potassium citrate, 2 fluidounces.
Syrup of orange, $1\ ^1/_2$ fluidounces.
Mix and give a teaspoonful or two every three or four hours.

Cardiac depression may be avoided by the exhibition of strychnine and alcohol. In the uræmia of pregnancy and puerperal eclampsia the hypodermic injection of pilocarpine may be of marked benefit, but in some cases it does more harm than good by its depressing influence. In the nephritis of middle and advanced life, many authorities consider that pilocarpine is contra-indicated. As a renal stimulant pilocarpine may be given in doses of $^1/_{30}$ to $^1/_{20}$ grain, either by hypodermic injection or by the mouth.

> An alarming case of uræmic convulsions relieved repeatedly by the hypo-

dermic use of pilocarpine until complete recovery ensued. W. J. F. Churchouse (Brit. Med. Jour., Jan. 28, '88).

Pilocarpine tried in a number of cases of uræmic poinsoning, but all of them died. Van Eman (Kansas City Med. Index, Nov., '88).

Pilocarpine in Bright's disease will nearly always diminish dropsy sufficiently to protect more or less against the danger of suffocative attacks, even when hot-air baths and other diaphoretics prove useless. D. Benezúr and S. Csatáry (Brit. Med. Jour., Feb. 25, '88).

Case of Bright's disease in which hypodermic injections of $^1/_4$ grain of pilocarpine greatly reduced the œdema and dropsy. J. G. Marshall (Lancet, Jan. 12, '89).

Pilocarpine exercises a decided diuretic action, under normal circumstances; its power is easily masked, by the marked increase which it produces in other secretions. Pilocarpine causes a diminution in the volume of the kidney and an increase of the arterial pressure, these effects being due to a direct, stimulating action upon the coats of the blood-vessels. Sabbatani (Jour. de Méd., de Chir., et de Pharm., May 6, '93).

Pilocarpine is of great service as a sialagogue, in doses of $^1/_6$ to $^1/_3$ grain by subcutaneous injection. Marked benefit observed from its use in cases of uræmia, beginning meningitis, chronic meningitis; in affections of the naso-pharynx and larynx, especially in œdema of the glottis; in scarlatinal nephritis, and in the initial stages of peripheral and spinal affections. It is sometimes desirable to associate it with iodide of potassium and red iodide of mercury. Harteop (Centralb. f. klin. Med., No. 41, '94).

Passive Effusions.—Pilocarpine has been used in dropsy, ascites, and hydrothorax. In dropsy of renal origin it is a valuable agent, but when due to cardiac trouble it is too depressing. In hydrothorax it is of considerable value, but thoracentesis is, perhaps, best, and elaterium or salines come next in efficiency.

Erysipelas.—Da Costa reports success from the use of pilocarpine in acute erysipelas. He recommends the hypodermic administration of $^1/_6$ grain every three hours until free sweating ensues, then every four to six hours. Its action is so prompt and effective that it may almost be regarded as a specific. The diaphoresis is at once followed by the retrocession of the rash, and an improvement in the general condition. In atonic cases, when the heart is weak and perspiration cannot be established by pilocarpine no beneficial action is observed (Waugh).

Hypodermic injections of pilocarpine recommended in facial erysipelas. Twenty-four cases treated in this manner, all severe, 20 presenting albuminuria and 4 retention of urine. The drug must be administered until the physiological effects are produced. Recovery took place in all his cases within eight days at latest, and in some cases in four days. Pilocarpine is contra-indicated in affections of the heart. If the erysipelas appear as a complication, the treatment is absolutely without efficacy. Salinger (Ther. Gaz., Mar. 15, '94).

Good results with the drug in erysipelas; its efficacy probably depends on the time which has elapsed from the inception of the first symptoms before treatment is begun. In cases seen very early success is almost invariable. G. W. Barr (Ther. Gaz., May 15, '94).

Fevers.—A dose of pilocarpine will generally succeed in aborting a malarial chill. It should not be used in asthenia.

Acute Congestion. — In the acute congestive conditions following fevers or exposure to cold — coryza, bronchitis, laryngitis, muscular or articular rheumatism, and similar affections—pilocarpine may be used with benefit in the early stage. Small doses of pilocarpine followed by quinine are, perhaps, as efficient as large doses and, withal, safer.

Jaborandi will arrest pneumonia in three or four days if it is administered in the congestive stage and free diaphoresis

is secured. A temperature of 105° F. in congestion of the lungs has repeatedly been reduced to a temperature of 99.5° F. within twenty-four hours by the use of jaborandi. J. B. Carrell (Med. and Surg. Reporter, Jan. 12, '89).

In parotitis (mumps) the relief from pilocarpine is prompt when given early.

Chronic Affections.—Chronic rheumatic disorders and sciatica have been ameliorated by diaphoretic doses of pilocarpine.

In a patient who suffered from two or three attacks of rheumatism yearly, the writer used hypodermic injections of pilocarpine, using $^1/_6$ gram, which led to complete recovery within six days. Drappier (Jour. des Sci. Méd. de Lille, Sept. 15, '94).

The fulgurant pains of locomotor ataxia may sometimes be relieved by subcutaneous injections of pilocarpine. Mitkowski has tried pilocarpine in persistent catarrhal jaundice with great benefit, in the hypodermic dose of $^1/_6$ grain every other day for three weeks. He attributes, moreover, a diagnostic value to the procedure. If the above treatment produces no effect upon the jaundice, the presence of a malignant growth is to be suspected.

In laryngitis with scanty secretion J. Solis-Cohen suggests the use of from 1 to 5 minims of the fluid extract of jaborandi to 1 ounce of water, in spray locally.

Pilocarpine is a specific for croup and all croupous diseases. Its action begins at once. The drug can be given by the mouth, subcutaneously, or in suppository. The duration of the disease is notably shortened by the use of pilocarpine and the mortality reduced to *nil*. The daily doses advised are as follow: Up to 1 year, $^1/_6$ to $^1/_3$ grain; 1 to 3 years, $^1/_3$ to $^1/_2$ grain; 3 to 6 years, $^2/_3$ grain; 6 to 10 years, $^7/_8$ grain; 10 to 15 years, 1 to $1\,^1/_8$ grains; adults, $1\,^1/_4$ grains to $15\,^1/_2$ grains. Sziklai (Wiener med. Woch., Nos. 32, 33, '94).

In bronchitis with asthma, in wintercough, and in hiccough jaborandi has proved of great benefit.

Patient whom obstinate, continuous hiccough had brought very low, and for whom many therapeutic measures had been employed without relief. Prompt success, however, followed the administration of a decoction of jaborandi. Küthe (Med. and Surg. Reporter, Apr. 21, '88).

Cutaneous Disorders.—In skin diseases characterized by a deficient secretion of the sweat-glands and in those of rheumatic origin, jaborandi has proved efficient. In chronic eczema Koltz has obtained favorable results from hypodermic injections of 10 to 15 drops of a 1-per-cent. solution of pilocarpine. Poulet suggests that the same procedure may be of service in the treatment of elephantiasis arabum. Jaborandi has alleviated urticaria, and doses of $^1/_{20}$ grain have proved remedial in hyperidrosis and bromidrosis.

Pruritus is not uncommonly relieved by this agent. The itching of jaundice is amenable to pilocarpine if the drug is well borne and diaphoresis ensues.

R. M. Simon, of Birmingham, finds nothing so useful as pilocarpine hypodermically in the treatment of pruritus senilis. It relieves the itching and allows the patient to sleep. In alopecia the use of jaborandi internally—or, better, applied locally—encourages the growth of the hair. If too much is used, small pustules may develop about the hair-follicles. Bartholow suggests the following in cases of alopecia:—

℞ Fluid extract of jaborandi, 1 ounce.
Tincture of cantharides, $^1/_2$ ounce.
Soap-liniment, $1\,^1/_2$ ounces.

Mix and apply night and morning with friction. For the same purpose Hare suggests the use of:—

℞ Fluid extract of jaborandi, 1 drachm.
Tincture of capsicum, 1 ounce.
Tincture of cantharides, $^1/_2$ drachm.
Castor-oil, 1 drachm.
Alcohol, enough to make 4 ounces.

Deficient Glandular Secretion. —Dryness of the tongue and aptyalism may be relieved by small doses ($^1/_{200}$ to $^1/_{100}$ grain) of pilocarpine. The dryness of the mouth often so troublesome in diabetes mellitus is relieved in the same manner.

In the agalactia of nursing women, small doses of pilocarpine restore the secretion of milk.

Ophthalmic Disorders. — Pilocarpine is useful in all disorders of the eye associated with increased ocular pressure. De Schweinitz recommends very highly the hypodermic use of pilocarpine ($^1/_{12}$ to $^1/_{10}$ grain daily) for opacities of the vitreous humor. Diaphoresis should be avoided. As a myotic (1 to 4 grains to the ounce) it is rapidly taking the place of eserine; 1 or 2 drops every hour may be used until the patient is relieved. Pilocarpine is useful as a tonic to the eye; to relieve eye-pain after excessive use of the eyes use $^1/_{10}$ grain of pilocarpine and 4 grains of boric acid to the ounce of distilled water, a few drops of the solution being dropped into the eye three times daily (Hare). Clinical reports show that pilocarpine in small doses is a very good remedy in tobacco-amblyopia and alcoholic amblyopia. Burnham, of Toronto, reports the good effects of the remedy in a case where the centre of each cornea was studded with infiltrations; the pupillary area was involved and vision was imperfect. A few drops of a 2-grain solution of pilocarpine may be employed locally with advantage in rheumatic iritis. Staderini advises pilocarpine nitrate ($^1/_8$ to $^1/_{10}$ grain) hypodermically, in many inflammatory diseases of the eyes, especially in those consequent upon rheumatism, as episcleritis, iritis, and idiopathic optic neuritis.

Good results from injections of small amounts (2 to 3 centigrammes) of concentrated solutions of pilocarpine in cases of blood in the anterior chamber, and in vitreous opacities after iridocyclitis and choroiditis without general disease. Bock (Centralb. f. die gesammte Ther., Mar., '88).

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In the treatment of conditions of the eye and ear in which jaborandi is thought to be useful, it is probably better to administer the alkaloid pilocarpine hypodermically rather than to employ the infusion. Laval (Ther. Gaz., Sept. 15, '97).

Aural Vertigo.—In cases of obstinate aural vertigo a most efficient treatment is the use of pilocarpine every few days in sufficient doses to produce some salivation, the patient lying down or going to bed after each dose.

Three cases of Ménière's disease in which the hypodermic use of pilocarpine gave satisfactory results. The medicament was given in daily doses of from $^1/_{25}$ to $^1/_4$ grain. These injections were generally followed by sialorrhœa and profuse diaphoresis. Labit (Revue de Laryn., d'Otol., et de Rhin., Sept. 1, '94).

Antidote to Atropine.—Although atropine is a very efficient antidote against poisoning by pilocarpine, pilocarpine is less potent as an antidote in poisoning from atropine. However, McGowan relates a case in which two injections of $^1/_2$ grain each were undoubtedly the means of saving the life of a patient suffering from belladonna poisoning. The same procedure is recommended as beneficial in acute alcoholism.

Patient quickly brought out of a condition of alcoholic coma by the adminis-

tration of pilocarpine and a hot-air bath. G. W. Davis (Kansas City Med. Index, Nov., '88).

C. Sumner Witherstine,
Philadelphia.

JACKSONIAN EPILEPSY. See Epilepsy.

JAIL-FEVER. See Typhus Fever.

JALAP. — Jalap (Jalapa, U. S. P.), named from Jalapa, a city of Mexico, is the dried tuberous root of the *Ipomœa Jalapa* (*Exogonium purga* or *Ipomœa purga*), one of the *Convolvulaceæ*, which is indigenous to Mexico. The root has a peculiar smoky odor, and an acrid, sweetish, and nauseous taste. As seen in the shops, it is usually in a yellowish-gray powder. The active principle of jalap is found in a double resin in amounts varying from 12 to 18 per cent., which is divisible into two portions: one (convolvulin) of which is hard and insoluble in ether, but soluble in alcohol and chloroform and partly soluble in water; the other (jalapin) is soft and soluble in ether and alcohol. Both are active purges, but convolvulin is more potent (dose, 1 to 3 grains) than jalapin (dose, 2 to 5 grains). Jalap also contains about 18 per cent. each of starch and sugar. According to Poleck, jalapin is a resinous glucoside, separable by the action of hydrochloric acid into sugar and jalapinolic acid, and identical with scammonin.

Preparations and Doses.—Jalapa, 10 to 30 grains.

Extractum jalapæ, 2 to 5 grains.

Pulvis jalapæ compositus (jalap, 35; cream of tartar, 65 parts), 10 to 60 grains.

Resina jalapæ, 2 to 5 grains.

Physiological Action. — Beyond the fact that jalap acts as a powerful hydragogic cathartic, and that gastro-intestinal irritation is produced by an overdose, little is known concerning the effects of this drug. It is also irritating when applied to the mucous membrane. According to Vulpian and Moreau, when applied to the exposed colon it gives rise to active peristaltic motion. Jalap passes into the milk of wet-nurses and purges their nurslings.

Poisoning by Jalap. — Jalap when taken in overdose acts as a simple irritant poison to the alimentary canal, the symptoms being copious watery stools, tormina, and tenesmus. The treatment of poisoning consists in the evacuation of the retained jalap by the stomach-pump and the use of demulcent drinks.

Therapeutics. — Jalap is used principally as an hydragogic purge to relieve dropsical effusions, anasarca, and ascites. The resin, being the active constituent (containing both convulvulin and jalapin), should generally be preferred. As it is almost tasteless and the dose small, it may be readily given to children in doses of $^1/_4$ to $^1/_2$ grain. Jalap is contra-indicated in inflammatory states of the intestinal canal. Combined with calomel, it is probably the best purge in cases where the liver is torpid. The compound jalap powder is most often used as an hydragogic cathartic for dropsy, either of cardiac or renal origin. In pulmonary congestion and distended right heart with cyanosis, dyspnœa, and so-called cardiac asthma, a teaspoonful of compound jalap powder will give relief. In hæmorrhoids it does not cause irritation, but relieves them by emptying the vessels above, and clearing out the liver.

JAMBUL.—Jambul is a tree that grows in most tropical climates, and belongs to the *Myrtaceæ*. It is the *Eugenia jambolana* of Lamk or the *Syzygium jam-*

bolana of de Candalle. From the fruits, by alcoholic fermentation, a liquor is obtained, the *jambava* of the Hindoos. This liquor, allowed to acidify, turns into a vinegar, of an agreeable taste, and is extensively used by them as a stomachic, carminative, and diuretic.

Three varieties of jambul grow in India, and the ripe fruit can be eaten in season; at other times the fruit preserved in spirit can be employed. The powdered seed in doses of about 5 to 10 grains three times a day is recommended as a very effective means of administration. A vinegar of a light-pink color can be prepared by exposing the juice of the ripe fruit, contained in porcelain vessels, to the heat of the sun; after the juice has commenced to ferment it is filtered and again set in a warm place for a fortnight, when it is ready for use. The best form is either the whole fruit preserved in alcohol, the powdered seed, or a fluid extract of the seeds. The pulp of the dried fruit is believed to be almost worthless.

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To obtain the seed fit for use it is necessary that the tree from which it is gathered should be of the right variety of jambul, and that no "wind-falls" or rotten fruit be included. The native physicians believe that this remedy is of the greatest use in the treatment of diabetes, and that there is no necessity to restrict the patient's diet, as this prevents the possibility of the excretion of sugar in the urine. Rudolf (Bull. Pharm., No. 1, '98).

Preparations and Dose.—The preparation generally employed is the powder, which may be given in doses varying from 8 grains to 1 drachm.

A fluid extract is more conveniently administered, and can be given in graded doses from 10 to 30 minims, according to the results obtained, in emulsion or capsules.

Physiological Action.—The manner in which the reduction of sugar in diabetic urine occurs when this agent is administered is not known, no untoward results having been noted in any case that could give a clue to its action. It acts as a gastric tonic through a principle that resides in the seeds, the bark, and the fruit of the plant.

Its properties, however, are principally in the seeds, which, according to the latest analyses, especially that of Elborne, contain essential oil, chlorophyl, resin, gallic acid, albumin, coloring extracts, and an insoluble residue. These grains appear to contain an active principle, a glucoside, to which the physiological effects of the plant are due, but which, as yet, has not been isolated.

Von Mehring has shown that phloridzin, a glucoside extracted from the apple-tree, the pear-tree, and other plants, has the power of producing sugar in the urine of animals. Groeser instituted a series of experiments upon animals, and administered phloridzin to dogs in the proportion of 15 grains per 2 $^1/_2$ pounds of body-weight, and was able to produce a considerable amount of glycosuria, which persisted from twenty-four to thirty-nine hours. It was also found that phloridzin caused diarrhœa. Assured of the effects of this glucoside, the experimenter then submitted the dogs to the conjoined action of phloridzin and the extract of jambul, and found that under such circumstances the sugar of the urine was invariably diminished almost to one-half of that secreted under the action of the phloridzin alone, and also that the duration of the glycosuria was considerably lessened. In pushing his experiments in order to determine the toxicity of jambul, Groeser noticed that as many as 5 drachms of the drug could be given in a day without producing in the dog

any deleterious effects, with the exception of some diarrhœa. (Egasse.)

Therapeutics.—The juice of the fresh bark, mixed with goats' milk, is said to be used in the treatment of infantile diarrhœa. It has also been used as an astringent in the form of gargles and lotions.

Diabetes.—The plant has been especially extolled in the treatment of diabetes. The natives of India and the English physicians were the first to speak in favor of jambul as a remedy for diabetes mellitus. The experiments of Lascelles Scott, T. A. E. Balfour, and G. Sims Woodhead show that jambul has the power to stop, in a marked degree, the conversion of starch into sugar, and that this action increases proportionately to the quantity of the drug used.

Following the results of the experiments of von Mering, clinicians have employed jambul, with varying success, in the treatment of diabetes in man. Egasse has shown that the drug can apparently do good only in the mild forms of diabetes, but in which kind of diabetes it will do the most good has not yet been determined. The facts so far collected point to the insipidus form. The drug has been employed mostly in the form of powder. The minimum dose may be set down as from 4 to 7 grains, repeated three or four times a day, but it can be increased to even 1 1/2 drachms in the twenty-four hours, according to the requirements of the individual cases.

Case of a man, 65 years of age, who, in spite of a diabetic *régime*, continued to present all the symptoms of a well-developed glycosuria. Before the drug was administered the patient weighed 175 pounds, and every twenty-four hours he would pass 5 1/2 pints of urine of a specific gravity of 1038, of a yellowish-green color, of an acid reaction, and containing 4 ounces of sugar. After a month's treatment the specific gravity of the urine was 1038: this was reduced to 3 1/2 pints every twenty-four hours, and the quantity of the urine lowered to 2 1/4 ounces. In seven more days the sugar was increased to 3 ounces, and the results in general were little satisfactory. In three more weeks the patient had lost 1 pound in weight, and both the quantity of the fluid and the amount of sugar continued to increase. The patient was again subjected to a diabetic diet and the powder of jambul in appropriate doses, but the ultimate results continued to be negative. The author, however, attributes the failure to the advanced age of the patient, which, in itself, made the case a rebellious one. A. E. Balfour (New Commercial Plants and Drugs, No. 11, '89).

Jambul in doses of 2 1/2 to 3 grains in pills three times a day diminishes the amount of urine and the percentage of sugar in diabetes, while sloughing ulcers attending the disease healed with surprising rapidity. In simple polyuria no effect was noticeable. H. Fenwick (Med. Standard, Feb., '88).

Four cases of diabetes treated with the drug, beginning with a dose of 5 grains and increasing to 15 grains three times a day, but without the slightest benefit. T. Oliver (Lancet, May 5, '88).

Three cases of marked glycosuria treated with jambul. In two cases the drug was employed in the form of powder, in doses of 15 grains three or four times a day, during twelve consecutive days. In the third instance the same amount was administered in the same manner for one hundred and forty-seven days, but no good results followed. Javeine (Wratsch, No. 47, '89).

Two cases of diabetes in which jambul was employed. Success was observed in the first case. In the second instance the drug proved wholly inefficacious. J. A. Granger and H. Vandenberg (Nederlandsch Tyd. voor Genees., vol. ii, No. 1, '90).

Extract of jambul used in the treatment of glycosuria, the rind being used instead of the fruit in the preparation. This makes it more agreeable in taste and much cheaper than the fruit. As much as 1 1/2 ounces per day can be ad-

ministered for a long period without disagreeable effects. It is best given in water or wine. Vix (Therap. Monats., Apr., '93).

JAUNDICE (ICTERUS).

Definition.—This is not a disease, but only a symptom-group, occurring under a variety of conditions and characterized by a yellowish discoloration of the skin, tissues, and fluids of the body with bile-pigment, and the excretion of the pigment in the urine.

It has been customary to classify all cases of jaundice into the two great groups of obstructive and non-obstructive jaundice, but, the more thoroughly the pathology of the condition is investigated, the greater is the number of non-obstructive cases that are found in reality to be obstructive, and in time it is probable that in all conditions jaundice will prove to be obstructive in origin.

William Hunter, in "Allbutt's System of Medicine," designates the two groups of jaundice as obstructive and toxæmic; these seem to be the most suitable terms at present available. The obstructive group includes all cases dependent on palpable obstruction; and the toxæmic those occurring in connection with some general infection.

Jaundice resulting from mental emotion, usually of a depressing nature, cannot be placed in either group; its nature is quite uncertain.

A nervous origin of many cases of jaundice maintained. Rockwell (N. Y. Med. Jour., Dec. 10, '92).

Case of jaundice due to emotion. It occurred in a woman of 24 years, apparently not neurotic, and manifested itself five or six hours after the nervous shock. Talamon (La Méd. Mod., Aug. 23, '93).

Case of jaundice developed after an instrumental delivery in a highly-sensitive young woman. E. A. Lubbock (Brit. Med. Jour., Apr. 21, '94).

Three cases noted in which jaundice supervened in children of nervous diathesis after emotional excitement. Coulon (Brit. Med. Jour., May 19, '94).

Two kinds of emotional jaundice distinguished: that coming on in a short time and passing off very quickly, and that in which the onset is slow and the course more protracted. The former is due to an immediate reflex dilatation of the vessels of the abdomen and contraction of the biliary vessels, as a result of which the bile finds its way in the direction of the lesser resistance into the blood. The other form is due, in the first place, to nervous atony of the intestinal walls and glands, as a result of which catarrhal inflammation is prone to occur and to extend into the biliary vessels. Potain (Union Méd., No. 70, '94).

Jaundice from suppression of liver-function cannot now be accepted as possible, as bile-pigment can only occur as the result of hepatic cell-activity. Further, the removal of the liver or the complete severance of its connections by ligature does not cause jaundice.

I. Obstructive Jaundice (Hepatogenous Jaundice; Extrahepatic Jaundice).

General Symptoms.—The color of the skin varies according to the intensity and duration of the jaundice. In cases of catarrhal jaundice with sudden obstruction the surface becomes rapidly stained a deep yellow. When jaundice has existed for a considerable time it changes to a greenish hue, which gradually passes into a dark-olive color, doubtless on account of the action of the air on the bile-pigment in the skin. This very dark color known as "black jaundice," though not pathognomonic of cancer in the liver, is rarely produced by any other disease. The icteric hue shows most distinctly on the pallid parts and to a much less degree on highly-colored parts, as the lips, florid cheeks, mucous membrane of the mouth, etc. We, therefore, look to the conjunc-

tivæ for the first signs of icteric discoloration.

Series of experiments on dogs leading to the following conclusions: 1. Contrary to accepted pathological doctrine, the bile which is eliminated by the urine and deposited in the skin, in cases of obstructive jaundice, does not find its way into the general circulation through being absorbed by the blood-capillaries. 2. It is the lymphatic system of vessels alone which absorbs the biliary matters in obstructive jaundice, and it is through the instrumentality of the thoracic duct that they reach the general circulation. 3. After the thoracic duct has been ligatured for some days, supplementary ducts form by the coalescence of either entirely new or pre-existing, small, collateral lymphatics from the thoracic duct, at a point below the seat of ligature, through which its lymph-stream passes vicariously into the right innominate vein. 4. After the common bile-duct is ligatured, the whole of the constituents of the pent-up bile do not become equally concentrated, the less soluble, such as cholesterin and mucin, being by far the most concentrated. 5. From the dogs experimented on having, in many cases, not only lived, but even gained in weight, after bile was prevented from finding its way into the duodenum, it may be inferred that the admission of bile into the digestive canal is not absolutely essential to life. 6. Ligaturing the thoracic duct not only prevents the occurrence of obstructive jaundice, after the occlusion of the common bile-duct in dogs, but checks it even after it has set in. Vaughan Harley (Brit. Med. Jour., Aug. 20, '92).

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By the aid of injected and safranin-stained microscopical liver preparations the following facts demonstrated: 1. The secretion-vacuoles of the liver discovered by Kopffer do not form the terminals of the bile-channels, but the liver-cells are filled with a fine canal-reticulum surrounding the nucleus: this reticulum is continuous with the intercellular bile-capillaries. 2. An injection of the liver-cells is possible by way of the blood-vessels, since a dense net-work of blood-capillaries surrounds the nuclei of the liver-cells. From these results the new theory submitted in reference to congestion-jaundice: In entering the blood-channels it is not necessary that the bile should go by the route of the thoracic duct; admission to the blood may occur in the liver-cells themselves by diffusion from the bile-capillaries surrounding the nuclei into the neighboring blood-capillaries. C. Nauwerck (Münch. med. Woch., xliv, 2).

Many of the secretions are also colored with bile-pigment. The sweat is yellow and stains the patient's linen. The tears and milk may also be colored, but the saliva is not stained nor do the secretions of the mucous membranes, not even of the bile-ducts and gall-bladder, contain any bile.

Inflammatory exudates, as the sputa of pneumonia, are bile-stained, as are also the exudates into the various serous cavities.

Since the removal of diffusible substances in the blood is chiefly by the kidneys, it follows that the urine contains more of the biliary coloring matter than any other secretion. It may be present in the urine before it appears in the conjunctiva even. The color of the urine may vary from a barely perceptible greenish-yellow to a dark-brown or even black color. Bile-pigment is invariably present in the urine in jaundice, except in chronic cases in which the obstruction to the bile-flow is suddenly removed, when the icteric hue of the skin will persist after the blood has been cleared of the bile-pigment. Bile-stained urine foams readily when shaken, and the froth is of a yellow color. Rhubarb and santonin, when administered, produce a similar color in the urine, but the froth is not yellow; the addition of caustic potash causes a red coloring of the fluid and the tests for bile-pigments are not obtained.

Gmelin's test is usually employed to determine the presence of bile-pigment, but it may fail to give a reaction even in the presence of 5 per cent. of bile. It is best made by placing a few drops of common nitric acid and of the urine on a white, flat surface and then causing them to run together. A play of colors results at the margin of contact, rapidly passing through various shades of green, blue, violet, and red, finally becoming a dirty yellow.

The following modification of it is much more delicate, revealing even 0.2 per cent. of bile, and should be employed in doubtful cases: "To 50 cubic centimetres of urine add 5 cubic centimetres of 10-per-cent. barium-chloride solution and 5 cubic centimetres of chloroform. Shake for several minutes. Set aside for ten minutes. The chloroform and precipitate of phosphates fall down, carrying with them all the bile-pigment. Now draw off the chloroform and the precipitate with a pipette. Place in a flat dish, and set over a basin of hot water until all the chloroform has evaporated. Allow to cool and pour off any fluid from the precipitate. The latter will be yellowish. Place impure nitric acid in drops here and there on the surface of the precipitate. If bile-pigment is present a play of colors appears round each drop." ("Clinical Methods," by Hutchinson and Rainy.)

The stained cellular elements in the urine afford a reliable test for the presence of bile-pigment. In chronic cases the urine may contain albumin and pigmented tube-casts.

In some cases of jaundice at least the urine is diminished in amount during the attack. By the tenth or twelfth day there is a crisis, with large excretion of urine and a corresponding increase in urea. Chauffard (Revue de Méd., Sept., '87).

In ordinary jaundice the color of both skin and urine is due to bilirubin. Leube (Centralb. f. klin. Med., Nov. 30, '90).

In those slight forms of jaundice in which bile-pigments do not appear in the urine in appreciable quantity the spectroscope furnishes a very delicate and accurate test. Parmentier (Gaz. des Hôp., p. 136, '88).

The following recommended as a simple method of detecting bile-pigment in icteric fluids: To about 1 ¼ fluidrachms of serous fluid add twice or thrice its volume of concentrated alcohol, and shake the mixture. Add as many drops of hydrochloric acid (10 to 25 per cent.) as will be required to dissolve the precipitation caused by the addition of the concentrated spirits, when the fluid will become clear. Bring the fluid to a boil, and if gall-pigment be present a blue-green color will appear within a minute or so. In a serous exudation containing only 1 part of bilirubin to 250,000 parts of fluid, the blue-green color became very conspicuous. When it is desired to ascertain the presence of an insignificant quantity of the coloring matter of the bile in concentrated fluids rich in albumin, the author proceeds as follows: To ¾ or 1 fluidrachm of the fluid add four or five times its volume of concentrated spirit, which will cause the precipitation of all the proteid substances present. Shake well several times and filter the fluid. Add several drops of hydrochloric acid and boil, when, if gall-pigment be present, a delicate blue-green color will appear. Israel Hedenius (Lakäref. forh., vol. xxix, Nos. 7, 8, '95).

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Jaundice may be distinguished from the yellow hue caused by malaria, cancer, lead poisoning, and some kidney affections by placing a few drops of the urine in a porcelain dish and causing a couple of drops of nitric acid to flow against it. If bile-pigment be present, a greenish tint will result, followed by blue, violet, and a yellow or brown. John Inglis (Columbus Med. Jour.; Monthly Retrospect, Apr. 15, '98).

As no bile enters the intestine, the

fæces are pale or clay-colored, on account of the large amount of fat present. They are pasty and usually fœtid. There is usually constipation, but diarrhœa is not infrequent, owing to the decomposition in the intestines. There may be no derangement of the stomach, but often there is loss of appetite, coated tongue, foul taste, fœtid breath, and epigastric fullness after food.

The clay color of the stools is due to the undigested fat, and in jaundiced patients who are fed on free fat food this peculiar odor is not present. Strumpell (Lehrbuch d. spec. Path. und Ther. d. inneren Krank., B. 1, '88).

In the absence of bile from the intestine, in jaundice, there is an increase in undigested fat from 6.9 and 10.5 per cent., the normal amount, to 55.2 and 78.5 per cent. Müller (Zeit. f. klin. Med., B. 12, H. 1. 2. '88).

Attention called to the difference between icterus from obstruction and true polycholic icterus, in which there is hypersecretion of bile. In the former the stools are alcoholic, while in the latter they retain their normal color. Polycholic icterus, rare in temperate climates, but very frequent in hot countries, is associated with an acute congestion of the liver, and is accompanied by fever. It does not last long unless it occurs in relapses. Icterus, not polycholic, yet without discolorization of the stools, may also occur when there is incomplete compression of the small bile-ducts. Jaccoud (Jour. de Méd. et de Chir. Prat., June, '90).

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Case of a girl of 16 years, who became jaundiced when six years old, and remained so six months. At thirteen there was another attack of jaundice lasting eight months, and at fifteen one of six months' duration. The fourth attack came on at sixteen, and when reported had lasted four months. According to the mother, an inflammation of the throat preceded every attack. In the previous attacks, especially the second, there was severe pain in the region of the stomach and liver, not colicky. Chills and fever have not been present. Recovery from the attacks begins suddenly. In the present attack there is no fever, the appetite is good, and bowels regular; the patient is emaciated and feels weak. The jaundice is intense; there is great itching. Ascites and enlarged spleen are absent. The liver is enlarged all over, dullness extending from the upper border of the fifth rib in the mammillary line to three fingers' breadths below the rib. The surface is hard, uneven, and sensitive. The fæces for months have been without bile-coloring matter. The case is probably one of gall-stone with secondary hypertrophic cirrhosis of the liver. Albu (Deutsche med. Woch., No. 13, '98).

Slow pulse is very characteristic; it is usually from 40 to 60, but may be down to even 20 per minute. Such pulse-changes are more frequent in catarrhal jaundice and are not usually of unfavorable significance. The respirations are usually normal, but may fall to 10 or less per minute.

In many protracted cases there is a marked tendency to hæmorrhages, especially to purpura and to subcutaneous extravasations. The blood requires in some of these cases eleven or twelve minutes to coagulate instead of three or four, as in normal states (Osler).

Surgical operations should only be undertaken in case of chronic obstructive jaundice with due regard to this change in the blood.

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Icteric blood is deficient in sodium chloride. This depends on a lack of NaCl and a reduction in the volume of the serum. The latter is produced by an increase in the volume of the red corpuscles, which, in turn, is due to the presence of bile-salts in the plasma. V. Limbeck (Centralb. f. innere Med., No. 33, '96).

In chronic jaundice there is a marked tendency to hæmorrhage and in operating upon such cases surgeons have to count this as a possible serious accident.

Within the past few years, the writer has known of three fatal cases of hæmorrhage's following operations under these conditions. A recent case suggests the possibility of the value of taking the blood-coagulation time. The case was one of jaundice with pains suggesting gall-stones, and Dr. Finney operated. The patient almost bled to death on the table. The wound was packed with gauze, and the patient was taken back to the ward in a very exhausted condition. He bled very actively every time an attempt was made to remove the gauze, and it was at least three weeks before all of it was taken out of the wound. His blood-coagulation time, as taken with Wright's tubes, was between ten and eleven minutes, more than double the normal. It certainly would be advantageous to test this point in cases of chronic jaundice before operation, and it might be worth while also to follow out Professor Wright's suggestion, and to give the calcium chloride in full doses for a period of ten days in order to increase, if possible, the coagulability of the blood. William Osler (Montreal Med. Jour., Jan., '98).

Pruritus is often a distressing symptom in the chronic forms of obstructive jaundice. It occasionally precedes the onset of the jaundice. It is worse at night and may be general or localized. Scratching gives rise to various eruptions. Sweating is frequent. Urticaria, lichen, and boils may be present, as may also xanthelasma.

Cutaneous pruritus, so common in jaundice from retention, may appear and persist for a long time before the icterus is evident. This precocious pruritus is observed especially in cases in which the obstruction to the flow of the bile is caused by a neoplasm situated somewhere along the course of the biliary passages. Bouchard (Med. Rec., Apr. 14, '94).

Cerebral symptoms may be marked, including irritability, great despondency, and even melancholia. There are often headache, vertigo, and dullness; there may be sleeplessness. Specially severe symptoms may develop in persistent jaundice and quickly prove fatal. Usually there is slight fever, rapid pulse, emaciation, and mild delirium. From this typhoid state the patient may soon become comatose or develop convulsions. This condition was formerly denominated *cholæmia*, or sometimes *cholesterœmia*. Its cause is uncertain, but probably most cases are due to a "terminal infection."

Literature of '96-'97-'98.

Cholæmia may be diagnosticated by the blood-plasma separated in the centrifugal tube, before the appearance of the icteric hue of the skin. G. W. McCaskey (N. Y. Med. Jour., Apr., '97).

Etiology.—This class includes the cases that "result from obvious mechanical obstruction" and are "independent of changes in the blood or bile" (Hunter).

Murchison classified this group as follows:—

1. Obstruction by foreign bodies within the duct, as gall-stones, inspissated bile, parasites, etc.

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Catarrhal jaundice is not merely a mechanical plugging of the bile-ducts with mucus, or a closure of the ducts with inflammatory swelling, but is really toxic in character, ordinary catarrhal jaundice being due to toxic substances developed in the alimentary canal. Obstructive jaundice is due to gall-stones, tumors, hepatic abscesses, and cirrhosis. If jaundice is associated with gall-stones, it is generally due to inflammation rather than to obstruction. Renvers (Modern Med. and Bact. Review, Apr., '97).

2. Obstruction by inflammatory tumefaction of the duodenum, or of the lining membrane of the duct and exudation into its interior.

Catarrhal or simple jaundice results from the following causes: 1. Duodenal catarrh, in whatever way produced, most commonly following an attack of indigestion. It is most frequently met with in young persons, but may occur at any age, and may follow not only errors in diet, but also cold, exposure, and malaria, as well as the conditions associated with portal obstruction, chronic heart disease, and Bright's disease. 2. Emotional disturbances may be followed by jaundice, which is believed to be due to catarrhal swelling. Cases of this kind are rare and the anatomical condition is unknown. 3. Simple or catarrhal jaundice may occur in epidemic form. 4. Catarrhal jaundice is occasionally seen in the infectious fevers, such as pneumonia and typhoid fever. William Osler ("Principles and Pract. of Med.." p. 430).

3. Obstruction by stricture or obliteration of the duct, as may result from perihepatitis, or from a cicatrix in the duct or at its mouth in the duodenum.

Case of chronic obstructive jaundice due to a narrowing of the ductus communis choledochus by a cicatricial band situated just at the junction of the cystic and hepatic ducts. The gall-bladder was atrophied. The liver and spleen contained pure cultures of the bacillus coli communis. Benzaçon (Bull. de la Société Anat., No. 6, '93).

The occurrence of jaundice is, as a rule, only possible when there is an obstruction of the common bile-duct. There are one or two exceptions, viz.: a rare form of blood-dyscrasia and yellow fever. Biliousness is the result of functional derangement of the liver, while jaundice is the result of obstruction of the common duct. Jacob Michaux (Gaillard's Med. Jour., vol. lxvii, No. 1).

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Case of fatal infantile jaundice from congenital narrowing of the bile-duct. J. A. C. Kynoch (Edinburgh Med. Jour., July, '96).

4. Obstruction by tumors' closing the orifice of the duct or growing into its interior.

Causes of icterus gravis: 1. Mechanical occlusion of the lumen of the cystic and common ducts by calculi, hepatic growths, enlarged head of the pancreas, carcinoma of the duodenum, tumors of the transverse colon, etc. 2. Acute yellow atrophy. 3. Terminal stage of atrophic cirrhosis. Mester (Deutsche med. Woch., Nov. 27, '90).

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Four cases in which death followed symptoms of obstructive jaundice due to cancer of the ductus choledochus communis with signs of excessive amount of colloid material in the thyroid gland. In those cases, the antitoxic function of the liver having been notably impaired, the thyroid was excited to vicarious action by the toxic substances circulating in the blood. Lindemann (Archiv für pathol. Anat., etc.: Gaz. Hebdom. de Méd. et de Chir., Nov. 28, '97).

Examination of the liver from a woman, aged 53, who had died after symptoms of obstructive jaundice. There was a large caseating gland surrounded by a dense mass of fibrous tissue involving the hepatic duct. There was also some perihepatitis with several small abscesses throughout the liver. Whyte (Brit. Med. Jour., Jan. 1, '98).

5. Obstruction by pressure on the duct from without by (*a*) enlarged glands, (*b*) hepatic tumor, (*c*) tumor of the pylorus, (*d*) tumor of the pancreas, (*e*) tumor of the kidney, (*f*) omental tumor, (*g*) an abdominal aneurism, (*h*) fæcal accumulation in the colon, (*i*) ovarian or uterine tumors.

Tight lacing has a decided effect on lessening the flow of bile. The free and unfettered action of the diaphragm is essential to normal biliary secretion and affects evacuation of the bile-ducts much in the same way as succussion of the liver which saddle exercise affords. W. G. Collins (Lancet, Mar. 17, '88).

Conclusions based on a study of jaundice and its treatment: 1. Long-continued biliary stasis, compromising the secreting cells of the parenchyma of the liver and producing a certain anæmia of

the organ, markedly reduces and sometimes suppresses the secretion of the biliary acids. The gravity of the phenomena described under the name of biliary intoxication does not, therefore, depend upon the action of these acids. 2. The scarcity or absence of bile in the intestinal canal modifies very seriously the chemical processes there taking place. 3. One of the most common of the gastric changes in the icterus is the suppression of hydrochloric-acid secretion. 4. There is little or no loss of carbonate of sodium in these cases. 5. The reaction of the contents of the stomach is usually alkaline, less often neutral or faintly acid. 6. The physiological activity of the bile and of the pancreatic juice in the intestine is retarded. 7. The chlorides in the urine is increased; there is a diminution of urea, with an abundance of products of the aromatic series. 8. The more marked these characters, the graver the disease and its clinical manifestations. 9. Alkaline treatment does not modify these conditions. The effect of the acid treatment is, however, to diminish the chlorides, to restore the normal acidity of the urinary reaction, to increase the excretion of urea, and to reduce that of the aromatic products; and, at the same time, there is a progressive increase in the weight of the body. Alivia (Med. Rec., Apr. 14, '94).

Treatment.—The prognosis and treatment are further considered in dealing with the various diseases that give rise to obstructive jaundice. (See LIVER, DISEASES OF.)

The following substances have been found by experiment to increase the flow of bile: Group 1. Urea, oil of turpentine, and terpine. Chlorate of potassium increased the flow by once or twice the normal. Further, benzoate and salicylate of sodium, salol, euonymin, and muscarin used subcutaneously increase the secretion two or three times the normal amount. Group 2. Substances producing only a slight or doubtful and inconstant increase are: alkaline salts, Carlsbad salts, propylamin, antipyrine, aloes, cantharitic acid and rhubarb, hydrastis Canadensis, ipecac, and boldo. Thus, cathartics and the alkaline salts are not cholagogic in non-cathartic doses. Group 3. Substances diminishing the secretion: iodide of potassium, calomel, iron and copper, atropine, and strychnine. In regard to calomel, the writers have not been able to confirm Rutherford, who believed that what cholagogic action calomel had was due to the transformation into corrosive sublimate. The last-named substance given by itself produced no increase. Prevost and Binet (Revue Méd. de la Suisse Rom., May to July, '88).

From a uniform success of 6 cases the subcutaneous injection of hydrochlorate of pilocarpine is recommended for the relief of itching in patients with jaundice. Goodhart (Brit. Med. Jour., Jan. 19, '89).

Thirteen cases of catarrhal jaundice in children treated without drugs, by the use of the faradic current, daily applications of five minutes being usually made. One electrode was placed over the gall-bladder and the other over the spine at the same level, or the two electrodes were grasped with one hand and applied in the region of the gall-bladder, and a current used which was powerful enough to excite strong contractions in the abdominal muscles. A milk diet was usually ordered.

The results showed striking improvement.

Three cases were treated by the current alone, an ordinary mixed diet being allowed. In these cases, as well, marked improvement followed after the second *séance*. The average number of applications required before recovery was seven or eight. Kraus (Archiv f. Kinderh., B. 10, p. 231, '89).

Successful treatment of catarrhal jaundice consists simply in the rectal injection daily of 1 to 2 pints of cold water at first of a temperature of 57° F., then of 59° to 65° F. The fæces became colored in the second to the fourth day and general symptoms rapidly improved. Krull (Berliner klin. Woch., p. 159, '87).

The good effects of olive-oil in the treatment of jaundice due to simple obstruction emphasized. T. Oliver (Lancet, Oct. 7, '93).

Massage recommended in the treatment of catarrhal jaundice. The method con-

sists in rhythmical compression of the hepatic region for ten minutes, thrice daily. Wechsler (Wratsch, No. 19, '93).

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For itching in jaundice the following is recommended to be rubbed in several times a day:—

℞ Ichthyol, 1 ¼ to 2 ½ drachms.
Alcohol,
Ether, of each, 2 fluidounces.

Boullard (Ges. Therapie, p. 380, '98).

II. Toxæmic Jaundice (Hæmatogenous Jaundice; Hæmo-hepatogenous Jaundice; Jaundice of Polychromia; Non-obstructive Jaundice).

In this form there is said to be no obstruction in the bile-passages. Such in most, if not all, cases is not correct, because, although the larger ducts are free, the bile-radicles within and around the hepatic lobules are obstructed to a greater or less extent by swelled epithelium, pigment-granules, and crystals of leucin and tyrosin. The obstruction in these cases is shifted from the larger ducts to the biliary radicles, many of which escape, so that the obstruction is rarely complete. The cause acts on the liver-substance in general and must, therefore, be toxic and conveyed to it by the blood, either of the general or the portal circulation. The toxin acts on the blood, and in its excretion by the liver leads to the secretion of a viscid bile, to irritation of the biliary radicles, and it may be to degenerative changes in the liver-cells.

There are cases of obstructive jaundice in which the occlusion occurs within the biliary lobules and is due to swelling of the epithelial cells. The swelling and degeneration of the hepatic cells are the result of the action of toxic substances introduced through the circulation. The treatment of this form of jaundice consists in the regulation of the diet, the improvement of the circulation and the blood, and remedies addressed to the liver to stimulate more active secretion, but, first of all, to reduce the cellular swelling so as to free the terminal biliary capillaries. Porter (Amer. Med.-Surg. Bull., Dec. 1, '94).

Hunter makes three groups of this class of cases:—

1. Jaundice due to poisons, as toluylendiamin, phosphorus, arseniuretted hydrogen, and snake-venom.

2. Jaundice occurring in various specific fevers, as yellow fever, malaria, pyæmia, enteric fever, typhus, and scarlatina.

3. Jaundice occurring in obscure infective conditions, as in epidemic, infectious, febrile, or malignant jaundice, icterus gravis, Weil's disease, and acute yellow atrophy of the liver.

In this class the jaundice is usually less intense than in obstructive jaundice. There is only a partial absorption of the bile-pigment by the lymphatics of the liver. Bile appears in the stools at some period of the history; it may be in excess, causing very dark fæcal discharges. There is usually more constitutional disturbance than in obstructive jaundice. In severe cases this is very pronounced—high fever, dry tongue, delirium, subsultus, convulsions, hæmorrhages from various parts, black vomit, all indicating severe constitutional infection.

All cases usually show (1) destructive changes in the blood; (2) alterations in the quantity and quality of the bile; (3) changes in the liver-cells and bile-ducts, varying in degree according to the irritant power of the toxin.

The destructive changes in the blood are shown by the occurrence of hæmorrhages especially from the mucous surfaces, as of the nose and stomach. The black vomit of yellow fever furnishes a striking example of such hæmorrhages. The changes in the bile are characterized by its increased viscidity, great increase

in its pigment, and lessening of the bile-acids. The parenchymatous changes in the liver are evidence of the action of the toxins on the liver. Similar changes occur in the kidneys.

In many varieties the toxins that excite these changes are generated in the intestinal tract, as gastro-intestinal symptoms are usually prominent in the initial stage of the illness. In this way we may account for the absence of specific organisms in the liver in acute yellow atrophy, for example.

In many cases of jaundice the sequel of events is first an accumulation of irritant products in the liver, causing an irritation and inflammation of the hepatic ducts, with intestinal inflammation following it. Chauffard (Revue Gén. de Clin. et de Thér., p. 678, '88).

Case of a strong, well-nourished boy, who, five weeks after birth, was observed to be jaundiced over the upper half of the body. The discoloration descended to the umbilicus, where it ended abruptly, being sharply defined by a well-marked line encircling the body. By the fourth week of treatment recovery was complete, and during this time there was no disturbance of the general health. McHardy (Brit. Med. Jour., Oct. 31, '91).

The bacillus coli detected in the blood and organs of a patient who died of icterus gravis. He does not think, however, that this micro-organism may be regarded as the sole producer of this form; he is rather inclined to believe that the infectious hepatic process may be produced by germs of a different kind. Vincent (Archives Gén. de Méd., Dec. 1, '93).

The form of icterus gravis in which the bacillus coli is found is accompanied by lowering of the temperature, while the other forms of the same disease which are accompanied by fever are characterized by the presence in the liver and blood of pyogenic microbes. Undoubtedly, however, the micro-organisms play a rôle in the production of the lesions and symptoms of icterus gravis. Hanot (Le Bull. Méd., Feb. 21, May 6, '94).

Case of primary icterus gravis observed in which the temperature always ranged below the normal. Death followed. Cultivations made with the blood and liver remained sterile and no micro-organism was demonstrated on staining the sections of that organ. J. Durante (Bull. de la Soc. Anat., No. 24, '94).

Four cases of icterus gravis in which the results of bacteriological examination led the writer to conclude that they could be regarded as variable stages of the same form of septicæmia caused by streptococci. Babès (Revue des Sci. Méd. en France et à l'Etranger, July 15, '94).

Three cases of icterus occurring in syphilitic subjects. The cases were remarkable in that the icterus occurred either at the time of the first skin eruption or at the time of the recurrences. The symptoms were essentially those of the ordinary icterus catarrhalis. The liver was also appreciably enlarged. Unlike the ordinary icterus, this was made to disappear very rapidly. Ordinary methods produced but slight effect upon it, but mercury caused a rapid disappearance. Joseph (Arch. f. Derm. u. Syph., B. 39, H. 3).

Icterus may be directly ascribed to syphilis in many cases where there is (1) absence of the ordinary causes of jaundice; (2) where there is coincidence of symptoms of the two affections in very pronounced form; (3) where the course of manifestations of both diseases runs parallel.

The abuse of alcohol in such cases is undoubtedly nothing more than a predisposing cause Chapotot (Lyon Méd., Nov. 22, '92).

Three cases of icterus coming on at an early period of syphilis noted. Table of forty-six additional cases added with a view of establishing the differential diagnosis between simple catarrhal and syphilitic icterus. The latter usually comes on suddenly, without being preceded by the digestive disturbances which are the prelude of the catarrhal form; in some cases the digestion remains excellent throughout, though, as in catarrhal jaundice, there is a distaste for fats. Another point to be noted is the absence of any etiological factor except syphilis. The jaundice usually appears with the first eruption, and is most frequent in

females. O. Lasch (Berliner klin. Woch., Oct. 1, '94).

Fatal case of icterus observed in the secondary stage of syphilis, the entire liver being found at necropsy to be invaded by gummatous hepatitis. Roque and Devic (Le Bull. Méd., Nov. 11, '94).

Jaundice may occur as a consequence of the administration of filix mas, particularly in combination with an oil, as castor-oil. In these cases there was great destruction of red corpuscles, and this is, therefore, looked upon as the cause. Grawitz (Berlin. klin. Woch., p. 1171, '94).

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The icterus of pneumonia is due to an accidental hæmolytic action of the diplococcus, and is, therefore, hæmogenic. Banti (Centralb. f. Bakt. u. Inf., Dec. 10, '96).

The mechanical theory of jaundice appears inadmissible. In so-called catarrhal jaundice there is, in reality, no catarrh of the ductus choledochus.

From an anatomical point of view, the mucous plug, which has been found in the common bile-duct in cases of catarrhal jaundice, is met with also in subjects who have never presented any yellow tint of the skin. The alleged impermeability of the ductus choledochus in jaundice does not exist. The principal argument against the mechanical theory is the rapidity with which jaundice supervenes after an attack of hepatic colic (usually about three hours).

Icterus, like the bile, can only originate in the liver, and there is consequently no hæmatogenous jaundice, properly so called. Jaundice supervenes when a portion of the bile passes into the lymphatic spaces, and thence into the thoracic duct and the blood. The condition must, therefore, be attributed to a disturbance of the secretory function of the hepatic cells. It is, in fact, a paracholia.

Jaundice by autointoxication is the result of a peculiar arrangement of the hepatic cells, and the same remark may possibly hold good of icterus neonatorum. Catarrhal jaundice is an infective paracholia, as are also the jaundice observed in Weil's disease and that of acute yellow atrophy of the liver. Idiopathic jaundice should be treated as an infective disease. Pick (Sem. Méd.; Amer. Med.-Surg. Bull., Jan. 10, '97).

Observations based on 57 cases of jaundice occurring among 15,799 cases of early syphilis. Syphilitic jaundice is characterized by (1) its appearance in the early secondary stage, (2) the presence of fresh specific manifestations, (3) the influence of treatment, and (4) its sudden development without gastric disturbance. Long duration is not characteristic of syphilitic jaundice. In typical cases this icterus occurs at a time when syphilis affects the skin and mucous membranes. Hepatic enlargement is not a striking feature in the disease. In 22 out of 50 cases the jaundice was noted within six months after the infection. The syphilis in most of the cases was severe. In 50 cases cutaneous affections were present in 18, affections of the mucous membranes in 16. Marked glandular enlargement was present in 41 out of 50 cases. Werner (Münch. med. Woch., July 6, '97).

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Accounts of five patients presenting more or less analogous symptoms. They all have chronic jaundice of moderate degree, with occasional periods of exacerbation. In the intervals between the crises the liver is not at all or only slightly enlarged, but the spleen is always large, and seems abnormally hard to the touch. During the crises the jaundice deepens and the spleen becomes still more enlarged and tender to pressure, while the liver undergoes only a moderate uniform increase in size, remaining smooth and soft. The fæces are always colored, excepting occasionally during the crises, when their color may be temporarily more or less completely lost. During the crises the urine becomes icteric and gives distinctly Gmelin's reaction, though usually during a short period only. At other times the urine contains urobilin and occasionally modified bile-pigments, but Gmelin's reaction can never be obtained, though this reaction can always be produced in the serum of the patient's

blood. There appears to be no special tendency to obstruction in the portal circulation, to enlargement of the subcutaneous abdominal veins, ascites, tympanites, or hæmorrhoids. In all the patients there were old troubles in connection with the functions of the digestive tract. All five patients were decidedly anæmic. There may have been slight fever during some of the crises, but otherwise the icterus is unaccompanied by any abnormal rise of temperature. The periods of exacerbation appear sometimes to terminate with a fit of polyuria. Some of the crises suggested the possibility of cholelithiasis, but gall-stones could not be found in the fæces.

Affection might be termed "chronic infectious icterus with splenic enlargement and crises of exacerbation."

Treatment recommended consists in careful general hygiene, strict antidyspeptic regimen, milk diet during the exacerbations, sustaining the strength, and seeing that the excretory functions are properly performed. G. Hayem (Presse Méd., Mar. 9, '98).

Jaundice is a somewhat rare complication of pregnancy, Karl Braun having observed the grave form only once in 28,000 pregnant women, and Winckel only once in 16,000 cases. William B. Young (Med. News, Nov. 12, '98).

Icterus observed in four cases from the use of lactophenin. Kurt Witthauer (Ther. Monats., H. 2, S. 111, '98).

In some cases, as in pyæmia and snake-venom, the poison finds its way to the liver through the general circulation.

Icterus Neonatorum.

Definition.—Icterus neonatorum is a mild transitory form of jaundice of uncertain causation appearing in infants soon after birth. There is also a severe form of jaundice caused by congenital absence or occlusion of the hepatic duct, or due to septic infections, especially pylephlebitis. As this form does not arise from the same condition in the adult, it is wiser to confine the true "icterus neonatorum" to the first form.

Symptoms.—The icteric tinge is generally the only symptom, the child otherwise being well. It occurs in delicate children oftener than in the strong. It is seen more frequently in hospitals than in private practice, perhaps because the light is better in the hospitals and records are more carefully made. It is of frequent occurrence, being noted in as many as 80 or even 90 per cent. in some reports. It is probable that careful examination of all infants will reveal this large ratio. When very slight it may be best detected on the red skin rendered pallid by pressure. It usually appears on the second or third day, increases for a day or two and then disappears, the whole duration being from four to five days to a week, lasting a fortnight in severe cases only.

"It is first and most distinctly seen on the face—especially on the forehead and about the mouth—and in the chest; later it appears on the sclerotics, and last of all on the hands and feet" (Thomson).

In contrast with ordinary obstructive jaundice the sclerotics are discolored only slightly and late.

The urine is usually normal, not staining the napkin; but in severe cases bile-pigment is present in it.

Dyspepsia, nausea, vomiting, eructations, and flatulence, with sour and green stools, are constant symptoms of icterus neonatorum, and occur either simultaneously or soon after the appearance of the jaundice. In many cases fever is present, especially in the evening. The cause consists in a gastro-intestinal catarrh caused by the irritation produced by the first food, which is often of an unsuitable character. The catarrh extends to the common bile-duct, which becomes obstructed. Quisling (Lancet, Jan. 27, '94).

Diagnosis.—This in uncomplicated cases is easy. The colored stools, the pale urine, and the absence of grave symptoms serve to distinguish it even when severe from obstructive or septic jaundice, and from syphilitic disease of

the liver, and obliteration of the bile-duct.

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Two children of the same mother died of jaundice. The first pregnancy ran a normal course. The child was healthy during the first four weeks of life, but at that period icterus developed, and continued up to the time of the child's death, which occurred on the first week of the seventh month. The liver was enlarged during life. There was a small abdominal effusion. During the second pregnancy the mother was jaundiced two weeks prior to her confinement. The offspring became jaundiced in the third month. The jaundice fluctuated and at times quite disappeared. The child gradually failed and died. At the autopsy the liver resembled that of acute yellow atrophy. In the red stage the kidney showed an advanced fatty degeneration. The pulp of the spleen was much hypertrophied. Brandenberg (Centralb. f. innere Med.; Inter. Med. Mag., Dec., '97).

Etiology. — It is of very uncertain causation; many theories have been advanced to explain it. Some have said that the condition is not a true jaundice, but pigmentation due to rapid destruction of red corpuscles in the first days after birth. The presence of bile-pigment and bile-acids in the pericardial fluids of icteric infants and not in others proves, however, the yellow discoloration to be due to bile, and bile is always the product of the liver-cell.

That the blood-destruction leads to a greater amount of pigment in, and inspissation of, the bile followed by partial stasis, and consequent absorption from the biliary radicles, is probably the most reasonable theory. The causes may, however, be various, and several may be active in the same case.

Undissolved biliary coloring matter and bile-salts are always to be found in the urine of icteric newborn infants, which proves the hepatogenic origin of the disease. Halberstam (Jahrbüch f. Kinderh. u. phys. Erzie., B. 27, H. 4, '88).

Icterus neonatorum is ascribed by several authors to late section of the cord, whereby a greater mass of blood is thrown from the placenta into the child's circulation, and a great destruction of red corpuscles and coloring matter ensues, followed by icterus. To test this view, 50 children were at once separated from the cord at birth, and 100 later, mostly after separation of the placenta. Of the 50, 36 became icteric and 14 remained unaffected. Of the 100, 71 were observed; out of these, 30 were icteric and 41 remained well. The intensity of color and length of duration of the jaundice were more marked in those early separated than in others. Schmidt (Archiv f. Gynak., B. xlv, H. 2, '93).

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The red corpuscles bear no etiological relation to icterus neonatorum. The number of erythrocytes during the first week of life is independent of the occurrence of jaundice. The fluctuations in particular are more dependent upon the changes in the volume of plasma. The "resistance" of the red corpuscles is the same at the time of birth as in the adult, and it is not altered in consequence of jaundice. Knopfelmacher (Wien. klin. Woch., No. 43, '96).

Icterus neonatorum is due to pathological causes supervening during the first moments of extra-uterine life, and not to physiological conditions attending the birth of the child.

On examining the liver in fatal cases venous stases and retention of bile in the bile-ducts was always present. The retention of bile is favored by anything which tends to prevent the full expansion of the lungs, or interferes with the free action of the heart, both of which conditions so frequently follow after a difficult labor. The jaundice develops most frequently about the third day, never appearing as early as the first, and rarely delayed as late as the fifth day. The duration of the illness is from six to fourteen days, and occurs, according to the author's investigations, 395 times out of 1000 newborn children. The icteric tint

is first observed on the nose and cheeks, and occasionally the face alone is jaundiced, the rest of the body remaining of a normal color. The color of the urine is unchanged in mild cases, but in severer attacks bile-pigment is present. There is often profound alteration of nutrition and slowing of the pulse-rate during an attack. Vermel (Presse Méd. Belge., June 1, '98).

Weil's Disease (Acute Infectious Jaundice).

In 1886 Weil described " A peculiar form of acute infectious disease characterized by jaundice, swelling of the spleen, and nephritis." This has been recognized by German writers as a new disease. But others have looked upon it only as what has long been described as "acute infectious jaundice," a name that serves sufficiently to designate it.

Symptoms.—The disease presents the symptoms that characterize acute infections generally. It sets in suddenly, usually with chill, followed by fever, pain in the back and limbs, loss of appetite, thirst, general malaise, headache, giddiness, and usually diarrhœa. The symptoms increase for a day or two, the temperature rising rapidly to 104° or 105° F., weakness increases, and there is mild delirium. Jaundice appears on the second or third day, with marked enlargement and tenderness of the liver and swelling of the spleen. The urine becomes albuminous and shows the other signs of acute nephritis. There is marked derangement of the digestion—furred tongue, nausea, and sometimes vomiting. The symptoms begin gradually to subside by the fifth to the eighth day. The persistent high temperature falls, gradually reaching the normal by the tenth or twelfth day. The jaundice abates with the other symptoms.

Epidemic of icterus occurring especially among children noted. Reports of 518 cases collected in Saxony during the autumn of 1889. The initial stage lasted three or four days and was characterized by fever, vomiting, constipation, and congestion of liver and spleen. The icteric stage appeared one or two days after defervescence and lasted about eleven days. Seventy-three per cent. of the children living in the region where the epidemic prevailed were attacked. Thirteen deaths were reported to the writer. Catarrhal conditions of the stomach did not predispose to the disease, while disorders of the respiratory tract, and especially influenza, did. It appeared to be both contagious and miasmatic. Meinert (La Semaine Méd., Aug. 27, '90).

Small epidemic of icterus among children attending the same school, but living in houses far apart. The attack commenced suddenly, with vomiting, prostration, headache, vague gastric pains, and, in the course of three or four days, intense icterus. The whole process lasted ten to twelve days. Denton (Revue Méd. de la Suisse Rom., Oct., '90).

In 9 cases of infectious icterus (Weil's disease), uræmia occurred in 2 cases, 1 fatal. Hæmorrhages were frequent, especially from the skin and nose. Suppurative otitis media occurred in 1 case. Recurrence in 1 instance followed an afebrile period of six days. Croupous pneumonia developed in 1 case, with fatal ending. In the third fatal case death was due to the severity of the infection. Münzer (Zeitschrift f. Heilkunde, B. 12, H. 2, 3, '92).

Two cases of infectious jaundice in neither of which was there obstruction of the bile-ducts. Toxic cases of this nature may become malignant through renal complications, which, in turn, react upon the liver. Rendu (Le Bull. Méd., May 28, '93).

An infectious icterus resembling typhoid in its clinical appearance. The phenomena are ushered in with pain in the head and limbs, the temperature gradually rising till it reaches 102.2° to 103° F., which height continues five to eight days. On the fourth or fifth day icterus appears, the spleen is enlarged, and the margin of the liver is prominent and painful. The tongue is coated. The urine contains albumin from the begin-

ning, but becomes dark on the fourth day, although the fæces are normal and sometimes colorless. The duration of the disease is between two and three weeks. It usually terminates in recovery. Two fatal cases, however, are on record. The necropsies revealed great reddening and swelling of the solitary follicles. Hoeppener (Med. Press and Circular, July 23, '93).

Literature of '96-'97-'98.

Three cases of contagious icterus in children, all of whom presented the same symptoms,—anorexia, fever, and icterus, —which, set in after the decline of the fever and which continued only for a few days. Two of the children belonged to the same class in school and the third came daily in contact with the first child. Ulrik (Ugeskrift for Läger, p. 265, '96).

Convalescence is usually uninterrupted, but in a certain number—about one-fourth—the fever recurs within a week, lasting five or six days, in only a few cases being accompanied by recurrence of jaundice, swelling of the liver and spleen, and albuminuria.

Convalescence is always slow, the strength not being restored for many weeks.

Of the symptoms, the most marked usually are the muscular pains, especially in the calves of the legs. The pains may be so severe as to obscure the other symptoms. They are much increased by movement and by pressure of the muscles.

Etiology.—It is met with usually among males between the ages of fifteen and thirty years, but has been seen in children as young as eight. It occurs usually in endemic outbreaks in summer, affecting chiefly workmen engaged in insanitary occupations or environments. It is rare in America. It doubtless belongs to the group of toxæmic jaundice, but as to the nature of the infection, whether specific or multiple, is still to be determined. In two out of three fatal cases Jaeger found a bacillus of definite characters in the organs of the body, and in the urine of four out of six cases that recovered, the same organism was found. Ducks and geese—frequenting the river in which these cases were supposed to have acquired the disease by bathing—were subject to a fatal form of jaundice, and in them similar post-mortem changes and the same organism were found.

It seems proved by the experience of military surgeons that jaundice may be a specific infectious malady developed in marshy regions and in much the same surroundings as those which produce malaria or typhoid fever. Parmentier (Gaz. des Hôp., p. 1142, '87).

Thirty-four epidemics of jaundice, all of which were purely local, confined to one place or part of a place, such as a camp, barracks, works, or even a house. Hirsch (Geography of Disease, '88).

Group of cases of epidemic jaundice, eleven in number, which occurred in five families living in Parkhead, Glasgow. Russell (Brit. Med. Jour., Aug. 11, '88).

Infectious icterus is a general acute specific-infectious, miasmatic, non-contagious disease. It may be sporadic, epidemic, or endemic, and, as a rule, runs a favorable course. It stands, in some way, in a certain relation to typhoid fever and to typhus biliosus. The infectious agent arises outside of the human body. The disease never relapses. Hennig (Volkmann's Sammlung klin. Vort., No. 8, '90).

Infectious icerus due to a proteus infection. Doubts concerning Banti's new bacillus. Jaeger (Deutsche med. Woch., Oct. 3, '95).

Case showing analogy between Weil's disease due to proteus and icterus neonatorum. Bar and Rénon (Comptes Rendus Hebd. des Séances, etc., May 24, '95).

Morbid Anatomy.—The liver-changes resemble those found in acute yellow atrophy, but to a much less degree. There is fatty degeneration and cloudy swelling of the renal epithelium, or even an acute parenchymatous nephritis.

Minute hæmorrhages exist in various organs and on the serous surfaces. The spleen is swelled. There are no traces of typhoid ulceration.

Prognosis.—Only a small number of cases have terminated fatally, but convalescence is protracted.

Treatment.—This is quite symptomatic. The pains will require anodyne for their relief.

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JAWS, DISEASES OF.

Alveolar Abscess, or "Gum-boil."

A gum-boil usually begins in the socket of a carious tooth. It is generally quite superficial, and gives rise to but few external signs, but occasionally, especially when due to a disorder at the root of a tooth, the active manifestations are accompanied by severe throbbing pain, considerable swelling of the cheek of the corresponding side, and with protrusion of the tooth from thickening of the peridental tissues. When the lateral incisors are involved, the abscess may spread posteriorly between the layers of the hard palate, or anteriorly in the direction of the nose, opening into the latter. When the molars are involved, it may penetrate the tissues of the face, thus leaving a sinus or scar. Necrosis and pyæmia have occurred in rare instances as complications.

Treatment.—The old-fashioned linseed-meal poultice is worse than useless; it tends to encourage the inflammatory process and to involve the cheek. Hot water as hot as can be borne held in the mouth is far better. Painting the gums with a 10-per-cent. solution of cocaine is sometimes temporarily effective in mild cases. Free leeching or lancing can be resorted to if the abscess progresses. Leeches should always be applied through leech-glasses, and not wrapped in a napkin, as often done. If these measures do not suffice the patient should consult a dentist.

Epulis.

Although applied to various neoplasms of the gums, the term "epulis" is only applicable to a growth of the alveolar process and tooth-sockets. Two varieties of epulis are recognized: the *simple*, or benign; and the *malignant*.

SIMPLE EPULIS.—A benign epulis is, in reality, a fibroma: a smooth, rounded projection of the gum, usually beginning between two teeth, which it gradually separates, displaces, and loosens. It may involve several teeth and involve the posterior or the anterior aspect of the alveolus. It is painless, of slow and indolent growth, but, if left to itself, it ulcerates and causes marked deformity. It sometimes ossifies.

MALIGNANT EPULIS.—This is a much more dangerous variety. Beginning usually at the socket, it is characterized by the presence of irregular multinucleated mass of giant-cells associated either with round or spindle cells, or both. It is really a myeloid sarcoma. It is exceedingly vascular, purplish red, grows much more rapidly than the simple epulis, and is finally transformed into a spongy mass, which projects in various directions and bleeds upon the least contact with a hard substance.

> Out of 1156 tumors that have been examined during the last eleven years at the Laboratory of Nantes, 32 have been epulis. Of these, 4 were in patients of 5 to 15 years, 12 of 15 to 40 years, 8 of 40 years and upward. Eighteen tumors were removed from females and 5 from males; 9 were seated in the lower jaw, and 7 in the upper. There is no evidence of its ever being epitheliomatous. Nine were true fibromas, 6, however, being partly myxomatous. Sarcoma is the commonest form, this being typically myeloid in

character. De Larabrie (Archives Gén. de Méd., Jan., '89).

Epulis regarded as a recurring tumor of malignant character and tending to destroy life. It seems to be definitely settled that epulis belongs to the sarcomatous group. It is a myeloid sarcoma, composed of fibrous tissue and myeloid cells, the former predominating, and it would appear occasionally to exist almost to the exclusion of the latter, and *vice versâ*. The greater the preponderance of myeloid cells, the greater the tendency to malignancy. Early removal means a cure. When neglected the tendency is to destroy life. W. B. Rogers (Memphis Jour. of Med. Sci., Apr., '90).

Myeloid epulis may ossify. I. Hutchinson, Jr. (Lancet, Apr. 5, '90).

Treatment of Epulis.—Whether the growth present be a simple or malignant one, the sooner it is removed the better. The tumor, and the tooth or teeth and the portion of the alveolar process involved, should be cut out, this constituting the only safe mode of treatment. Mere scraping is followed by a return of the tumor in almost every case, whether simple or malignant. The portions of bone to be removed being mapped out, two vertical incisions are made with a Hey saw, and the diseased mass is removed with forceps, after having been dissected from its surroundings.

Four cases of epulis personally operated upon, in all of which an attempt had been made to remove the growth without sacrificing the teeth, and in all there was prompt recurrence. Thus far the prompt removal, after drawing the teeth from whose base the tumor had sprung, has been effectual, and was likely to continue so. All cases of tumor of this kind removed at the hospital from 1878 to 1888 have been followed, and neither recurrence nor death has occurred. Where the growth appears on both sides of the alveolar process, at least one of the teeth, and often both, must be drawn to give free access to the periosteum. In this disease the dangers of palliative delay are not great, on account of the fact that it has, in the beginning, at least, only local malignancy. M. H. Richardson (Boston Med. and Surg. Jour., Oct. 2, '90).

Conclusions from observations of epulis: 1. In none of personal cases of epulis have evidences of general or secondary invasion been observed, and it has been sufficient to remove the tumor and to extract the roots or teeth with which they were connected to cause the arrest of the disease. 2. In all cases treated there has been a great neglect of the hygiene of the mouth. This has been the case especially with persons working in copper, or cutlers, whose teeth accumulate a characteristic tartar which appears to predispose them especially to these neoplastic formations. F. D. Rodriguez (Cronica Médico-quir. de la Habana, Oct., '90).

Necrosis.

Necrosis of the jaw may be due to any condition liable to give rise to inflammation of its periosteum by injury due to extraction of teeth, by various suppurative diseases, the acute exanthemata, pyæmia, actinomycosis, etc., or by the action of various diathetic processes, such as syphilis, tubercle, or leprosy. It is most frequently caused by the fumes of phosphorus (see beyond), and by mercury taken internally. Deficient nutrition, scorbutus, or other conditions in which the organism is deprived of its vital pabulum frequently manifests necrosis of the jaws as a symptom. It may thus occur at any age, and does seem to show a predilection for either the upper or lower maxillary.

Necrosis is always preceded by deeply-seated and intense pain; the parts are red, inflamed, and tumefied. After a time the pain is somewhat reduced and sinuses are formed, from which a fœtid pus exudes. The teeth are loosened and fall out, and the cavity left is bathed in pus. A probe passed in any of the sinuses reveals the presence of dead bone by conveying to touch the characteristic sensation of roughness. Portions of the

bone become detached and are easily removed.

Case of a boy, aged 6 years, taken sick with influenza in December, 1889. During convalescence fœtor and swelling of the mucous membrane of the right cheek noticed. Fever set in on the fourth day, and a gangrenous area was noticed which spread rapidly to the right half of the upper lip and invaded with special violence the osseous portion of the upper jaw. The whole of this bone was completely carious. The face on the right side presented an enormous œdema, which hid the eye completely. There was an abundant and fœtid salivation and an odor of cadaveric putrefaction.

Complete excision of the diseased upper jaw was performed by which the whole of the osseous lesion was removed. The gangrenous soft parts were partially removed and burned with the Paquelin cautery, and the cavity packed thoroughly with iodoform gauze. In two months there was complete recovery without marked deformity. Christovitch (Bull. Gén. de Thér., Nov. 15, '90).

Difficult and complicated deformity of the lower maxilla, resulting from long-standing necrosis and caries, of doubtful origin, successfully treated. The patient, a male aged 40 or 45 years, lost the two lateral halves of the lower jaw. In consequence of this the anterior portion of the horseshoe, formed by the jaw, which had yet attached to it the incisors, the canines, and the molars of each side, was thrown backward in an inclined position downward, which made it impossible for the teeth to meet, and also caused a very ugly retraction of the chin. By means of splints and plate, and subsequent modifications, excellent results were obtained, in spite of the carelessness of the patient and many obstacles which seriously interfered with the prothetic treatment. Martin (Lyon Méd., Mar. 27, '92).

Phosphorus Necrosis.

Symptoms. — Phosphorus necrosis comes on gradually, and sometimes long after the patient has been exposed to its toxic influence in connection with his occupation, the manufacture of matches, etc. But, once started, it progresses rapidly, involving large areas of bone; owing to the general toxæmia, many foci of inflammation may be developed at once. The lower jaw seems to be that in which phosphorus necrosis most frequently occurs.

Pain is one of the earliest symptoms; at first intermittent, it soon becomes continuous. Suppuration of the perialveolar and peridental membranes occurs, pus appears at the alveoli, and the inflammation soon includes the gum-structures, the tissues of the face becoming infiltrated, and the characteristic deformity appears. The entire periosteal layer is then invaded, sinuses are formed, opening into the mouth and externally under the lower maxillary edge; and pus is exuded on all sides. The pain becomes less marked when this stage is reached, unless the necrotic process involve the condyle, when severe pain in the ear is experienced.

The general health of the patient soon suffers considerably. The constant discharge, the presence of offensive pus in the mouth and stomach (much of the discharge being swallowed), the occlusion of the jaws through infiltration of the maxillary muscles and the impediment to the ingestion of food, combine to rapidly bring on exhaustion and death unless proper treatment be instituted.

In some cases, however, the process is a slow one, and comparative health is enjoyed while now and then a necrotic sequestrum is discharged through one of the sinuses.

In some operatives, however, a special susceptibility to phosphorus exists, and acute symptoms—nausea and vomiting, etc.—indicates an acute poisoning that requires immediate cessation of all work in which phosphorus is handled or inhaled.

Etiology and Pathology.—The inhalation of the vapor of phosphorus and the particles of this substance taken in with the food when the hands are not properly cleansed and improper care of the teeth combine to very gradually bring on the general toxæmia. This, in turn, gives rise to slow disintegration of the red blood-corpuscles and fatty degeneration of the arterial coats. That the maxillary bones should, of the entire osseous system, bear the brunt of the disease demonstrates that a local factor must play a prominent part in the disease. It is thought that the peridental membrane laid bare by accumulation of tartar, and whose vascular supply is already diseased by the general toxæmia, is easily influenced by any phosphorus that may enter the mouth, and thus readily yields to the irritation induced, carious teeth and other infectious foci, and that the necrotic process follows the local inflammation engendered.

Treatment. — In the early stages the teeth should receive careful attention, carious ones being extracted, while the tartar around those not diseased should be carefully removed. These manipulations should be conducted antiseptically, strict care of the teeth following.

Turpentine, according to Hohler and Schimpf, when exposed some time to the air becomes rich in ozone, and prevents fatty degeneration. Theoretically, it is thus capable of neutralizing the effects of phosphorus: a power which has also been demonstrated practically. Andant found that it arrested the vapor of phosphorus in the dark. The ordinary American oil of turpentine is of no value, however, unless it be long exposed to the air. It is to be administered internally and by inhalation. Potassium permanganate is also a valuable antidotal agent. The general health should be carefully watched and every means used to facilitate increased nutrition by the use of tonics and easily-digested foods.

In the stage of ulceration antiseptic washes as warm as possible should be frequently used. A weak permanganate-of-potassium solution is particularly valuable in this connection, when syringed into the sinuses. This being done, iodoform gauze can be packed in to absorb secretions to avoid their mixture with food. Sequestra should be removed when free, and the cavity packed. Mears advises that, when the lower jaw is involved, but half of the ramus should be removed at one time, to preserve the contour of the parts. After the expiration of eight or ten weeks the remaining portion may be removed.

New method of operating in the treatment of phosphorus necrosis of the lower jaw. Two sittings are required for operation. In the first operation an incision is made along the lower border of the jaw, by which all the soft parts, including the periosteum, are incised to the bone; the periosteum is completely detached, together with the osteophytic layer, until the necrosed bone remains bare. A very thin layer of iodoform gauze is then introduced between the bone and the periosteum. Five weeks later the necrotic bone is excised. During this time the periosteum has become a firm bony capsule, which has the shape of the jaw, so that outline of the maxilla is preserved after the removal of the sequestrum. K. Jervell (Norsk Mag. for Lægevid., '89).

Case of phosphorus necrosis of the left superior maxilla, in which the necrosed jaw was successfully removed by subperiosteal and intrabuccal operation. Fusci (Riforma Med., Apr. 27, '91).

Value of hydrogen peroxide extolled in the treatment of alveolar necrosis of jaws. Cassel (Deut. med. Woch., p. 554, '89).

When the patient cannot avoid exposure to phosphorus-fumes, the pre-

ventive measures should consists in free ventilation, absolute cleanliness, especially of the mouth and hands, and disengagement of the vapor of turpentine in working-rooms. Cloths may be soaked in this substance and spread out close to where the exposed subject is working.

JEQUIRITY.—Jequirity is the Brazilian name given to the seeds of the *Abrus precatorius*. Abrus, or wild licorice, one of the leguminosæ, is a climbing shrub indigenous to India, but now naturalized elsewhere in the tropics. The seeds, or beans, are small, nearly round, of a bright-red color, with a black spot at the hilum, are inodorous, and have a slight bean-like taste. They are employed in India as a standard weight (about 1 $^1/_2$ grains). Warden and Waddell, of Calcutta, claim that the seeds are inert when taken whole into the stomach. The seeds contain abric acid and an albuminoid active principle (abrin), which is composed of paraglobin and alpha-phytalbumose, which closely resemble snake-venom in their action, though less powerful. Abrin occurs as a brownish-yellow powder, soluble in cold water and in glycerin. It is precipitated from aqueous and glycerin solutions by alcohol. Abrin is a powerful cardiac poison. The root of the plant is official in the Pharmacopœia of India as a substitute for licorice.

Physiological Action.—Klein has shown that the poisonous properties of jequirity cannot be due to a bacillus, while Warden and Waddell found it to be due to the action of a poisonous proteid. The proteids in the seeds are two in number: a globulin and an albumose. S. Martin and R. N. Wolfenden found that globulin produces local œdema and inflammation when subcutaneously injected or applied to the eye (with post-mortem petechiæ beneath the serous membranes), and hæmorrhagic gastro-enteritis. It also causes a remarkable fall of body-temperature after subcutaneous injection, and in lethal doses it causes rapidity of breathing shortly before death. It has little or no effect on blood-pressure. The activity of this globulin is destroyed by heating the solution to 75° or 80° F.: the temperature at which it enters into a condition of heat-coagulum. Martin also found that the symptoms produced by the albumose closely resemble those noticed when the globulin is hypodermically injected. There is gradually-increasing weakness, with rapid breathing and lowering of body-temperature, but no convulsions or paralysis. It also causes severe conjunctivitis when applied to the eye. Its poisonous properties are lessened by heating at 70° to 75° F., and completely destroyed at 85° F. The albumose is not, however, so powerful a toxic agent as the globulin, the dose necessary to produce the same effects being larger. A similarity between the action of the proteids and those of other poisonous substances of the same class, especially those in snake-venom, is suggested.

Poisoning by Jequirity.—An acute conjunctivitis follows the topical application of the infusion or powdered seeds. While pounding the seeds one is liable to an attack of conjunctivitis, rhinitis, or bronchitis, and any cuts or scratches on the fingers become swollen, painful, and the centre of an erythematous blush. The careless handling of abrin is extremely dangerous to the eye and the nose, and the smallest particle may be fatal in the slightest wound. Abrin is not used internally; it is very poisonous, $^1/_{100}$ grain being a fatal dose for a man of 130 pounds in weight. The lethal symptoms of the internal use or hypodermic

injection of abrin are faintness, vertigo, vomiting; cold, clammy surface; dyspnœa; small, frequent, irregular pulse; convulsions, and collapse. Death occurs from cardiac paralysis.

> Albuminous principle isolated from *Abrus precatorius*, which is 100 times more poisonous than strychnine, and acts in the same manner on the system as the poisonous principle extracted from castor-oil seeds. Death is caused by the coagulation of the blood-corpuscles. Kobert (Ther. Gaz., Feb., '90).

Treatment of Abrin Poisoning.—Cardiac stimulants, digitalis, amyl-nitrite, ammonia, and whisky are to be exhibited, and external warmth applied.

Therapeutics.—In this country jequirity has never been used internally in medicine. At present the use of jequirity is limited to those obstinate cases of granular conjunctivitis and pannus, especially the latter, which have resisted other modes of treatment. Its action is chiefly by replacing an existing inflammation by another of stronger type, but of temporary duration. Although jequirity is said to have been used in Brazil for centuries as a popular remedy for granular cystitis and pannus, it was de Wecker, of Paris, who, in 1882, revived interest in the remedy by the publication of reports of its successful use in his practice. He recommends its use as follows: Powder 32 jequirity-berries and macerate them for twenty-four hours in one pint of cold water; add an equal quantity of hot water, and filter when cool. Sattler advises that the husks of the seeds be removed by means of hot water before the infusion is made. The seeds are then powdered and 6 fluidounces of hot water added. This infusion is allowed to stand for twenty-four hours, when it is filtered. Andrews recommends that the husks be rejected, the berries ground and macerated for twelve hours in cold, distilled water, and that then the infusion be filtered, care being taken that the preparation be made in a clean vessel and the maceration be conducted in a cool place. In any case, the solution should be used while fresh. Decomposition renders it unfit for use, and dangerous.

Any one of the above infusions being selected, a portion is painted on the conjunctival surface of the eyelid with a brush. This procedure is followed by an acute diphtheritic inflammation, lasting three or four days, and attended with fever and pain in the eyes and in the frontal region. This so changes the chronic process present as to permit of a cure. If an excessive action is developed, it may be controlled by hot compresses made of very dilute solutions of corrosive sublimate (Hare). If the first application gives rise to but slight reaction, it may be repeated after an interval of twenty-four hours.

De Wecker reported that the jequirity inflammation was peculiar in that it did not tend to spread to the cornea or other tissues, but was confined to the conjunctival sac to which it had been applied. Instances, however, have been reported where the inflammation spread to the face, neck, and the upper part of the chest. Warren and Waddell report a case of sloughing of the cornea from a single application of a somewhat concentrated infusion of the seeds. An infusion (3 per cent.), prepared with cold distilled water, prepared fresh, and used while fresh, is advised.

Purulent conjunctivitis contra-indicates the use of jequirity.

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JOINTS, SURGICAL DISEASES OF.

Varieties. — The affections to which joints are liable are almost all due to

inflammation and its results. Their character varies according to the causes which originate them and the extent to which the disease progresses. If the inflammatory action is confined to the lining membrane of the joints, then it is designated as a *synovitis*. If, however, it goes farther, and involves the remaining structures in addition, then it is spoken of as an *arthritis*. If pus is a prominent symptom, it may be called a purulent synovitis or arthritis, although when this occurs it is more apt to be regarded as an arthritis. Micro-organisms play an important part at times in joint-inflammations. These are usually of the ordinary pus-producing kinds, such as produce suppuration in ordinary wounds, or sepsis. When this is the case, one speaks of a *septic arthritis*. If the exact source of the infection is known, then the specific cause of the affection results in naming it according to its origin. Thus one speaks of *rheumatic, gouty* or *tubercular arthritis,* also of *gonorrhœal* or *syphilitic*. Sometimes a special name is given, such as *osteoarthritis,* not indicating its origin, but rather the parts affected; also *Charcot's disease* of the joints, so named after him who described it.

Loose bodies in joints occur as the result of injury or disease. When the disease affecting a joint pursues an extreme course, the functions of the joint are destroyed and it may no longer bend. This state of more or less complete fixation is called *ankylosis*, and, after the diseased process has died out and entirely ceased to act, it alone remains and may be the cause of the patient's seeking the surgeon and demanding relief.

Synovitis.

Synovitis is the name given to a simple inflammation, which is supposed to be limited to the synovial membrane. It is apt to be incorrectly applied, at times, on account of other structures of the joint being affected at the same time. The term simple synovitis is of considerable service to designate those inflammations which cannot be traced to specific irritants, such as gout and rheumatism, nor to disease of contiguous structures, such as the bones.

Symptoms.—The symptoms are those common to inflammations in general, such as pain, heat, redness, and swelling, with impairment of function, as well as others due to the peculiarities of the special structure or part involved.

Acute Synovitis.—In acute synovitis the pain may vary from slight to excessively severe. The rapidity with which the effusion may occur can cause intense pain by distension of the joint-capsule. The joint may be red and hot to the touch and very tender. The swelling is due mainly to distension of the joint, both by the increase in size of the synovial fringes and to the increased effusion. Swelling is a most important symptom, and it is much more marked in some cases than in others. In such joints, as the knee, that are not deeply covered by soft parts the swelling is marked and peculiar in shape, while in those which are not so superficial, as the shoulder and hip, it may be so slight as not to be evident. In these latter joints there may be a slight uniform enlargement which it would be difficult to say was not due to the bruising of the soft parts in case the affection followed an injury. In the knee and ankle, on the contrary, the swelling may be marked, and follow accurately the outlines of the joints. It is influenced in its shape by the overlying structures. Thus, in the knee-joint the swelling of the synovial fringes below the patella causes a protrusion at that point, which is more marked on each side of the tendo-patellæ.

There may be a swelling above the patella or on each side. The patella is likewise lifted up away from the femur by the effusion, forming the so-called floating patella; or, pushing the patella downward, it can be felt to strike against the condyles beneath. When the subfemoral bursa communicates with the joint, the swelling often extends quite a distance above the patella. In the ankle-joint the swelling is more toward the sides, but is also seen in front. Behind, it is not so marked except on each side of the tendo Achillis, which, however, does not play so prominent a part in the symptoms of affections of this joint as do the patella and its tendon in those of the knee. In the elbow the tendon of the triceps muscle also causes the swelling to be more marked on each side than in the middle. Impairment of function is usually marked, and movements are very painful in the acute type of the affection. Not only does pain interfere with the joint's functions, but the effusion into and distension of the joint prevents it from performing them by rendering it looser and less secure; so that weakness is marked, and, even if pain is absent, the joint is practically useless.

Subacute Synovitis. — In subacute synovitis the symptoms may be less abrupt in their onset and less violent in character. An acute attack may be slow in subsiding or the affection may be mild from the start. The heat, pain, and redness are not so marked as in the acute type, and the antiphlogistic measures of treatment are not required to be so pronounced.

Chronic Synovitis.—In chronic synovitis the symptoms are characterized by their persistence. The acute pain gives way to a dull persistent pain, aggravated by use of the joint to such an extent as to forbid it entirely. The redness may disappear, the heat may be slightly or not at all above that of the opposite side, but the swelling usually remains and forms a most prominent symptom. The swelling of the membranes of the joint may overshadow the effusion, and then the joint has a boggy or doughy feel, which is highly characteristic. The swelling may be very great, due to the large amount of effusion. Effusion of lymph is most apt to occur in the violent inflammations of acute attacks. Pus does not often occur in cases of simple synovitis, because infection is lacking. Should this, however, from any cause take place, then it forms quickly enough. The existence of chronic synovitis implies disuse of the member affected for a considerable time. Trophic changes therefore occur which produce a marked condition. The muscles above and below the joint atrophy, while the joint remains swelled, and each tends to aggravate the appearance of the other; so that together they form a picture of helplessness which is amply borne out by the total inability of the patient to use the joint. If a joint of the lower extremity is affected, the patient is compelled either to refrain from walking or hobbles about only with the greatest difficulty, while if the upper extremity is involved the arm is usually carried in a sling.

> Peculiar form of chronic synovitis of the sheath common to the short extensor and long abductor of the thumb observed in two cases. Kocher's fibrous stenosing synovitis,—more or less pain in sheath, irradiating throughout forearm. F. de Quervain (La Semaine Méd., July 10, '95).

Etiology.—The principal cause of simple synovitis is injury. The joint may have been knocked, bruised, or strained. Exposure to cold and wet may be followed by a simple inflammation of a

joint, with no other evidences of rheumatic or other constitutional affection. Sometimes the disease seems to appear without immediate cause, but in these cases the affection has probably been the result of an injury so slight as not to have attracted the attention of the patient at the time or else have been since forgotten.

Pathology.—The affection consists of an inflammation of the synovial membrane of the joint with an outpouring of synovia, serum, lymph, or pus into the joint-cavity.

The joint-surfaces may lose to some extent their smooth, glistening character, the synovial fringes become injected and begin to proliferate and tend to encroach on the interior of the joint and the surrounding cartilage. The natural secretion of the joint may become increased, it may contain lymph or even pus. In a quickly-occurring synovitis the secretion may be thinner than normal, owing to the sudden outpouring of serum. Not infrequently the injury which has produced the synovitis may likewise have caused some bleeding into the joint, in which case the contained fluid will be blood-stained or consist even of blood-clots.

Treatment.—The treatment of synovitis varies with its acuteness. In a sharp attack constitutional disturbance may be marked, the pain is severe and fever high, the patient is tortured by suffering and deprived of sleep. The usual antiphlogistic treatment is here of service: a free saline purge is of service aided by acetanilid or phenacetin. To produce sleep sulphonal or trional may suffice, or if the pain is more severe Dover's powder or other opiate may be given in sufficient quantities to procure rest.

Local treatment is all important. Complete rest of the part is essential. If the knee is affected sand-bags may be placed on each side or a pasteboard splint on the back of the leg fastened by adhesive straps above and below the joint, leaving the latter exposed for treatment. A cradle should be used to prevent the bed-clothes from touching the part.

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In the treatment of acute synovitis by adhesive plaster, the following is usual plan of procedure in acute synovitis of the knee (which is the joint most commonly involved): The limb being in the position of greatest possible extension, a pad of cotton wadding or absorbent cotton is carefully and smoothly placed back of the knee, well filling the popliteal space and covering the hamstring-tendons; next, sheet cotton (cotton batting) torn or cut into ordinary bandage-width is wrapped around the limb from six or eight inches below to the same distance above the patella; then strips of rubber adhesive plaster, one inch wide and long enough to more than encircle the limb, are applied over the soft, cotton dressing as follows: Beginning four to six inches below the joint, according to the size of the limb, the leg is encircled like a garter with a strip of the plaster, which is drawn quite snug and the ends stuck together; above this, and overlapping one-third, a second strip is applied: and so on, strip next to strip, each overlapping the one before, drawing them snug and sticking the ends together, until the joint and from four to six or more inches of both leg and thigh are incased in a firm, adhesive plaster support. Over all a muslin bandage is applied.

When the plaster becomes loose, in consequence of the subsidence of swelling, it should either be made snug again by applying additional strips, or, better still, entirely removed and a new dressing applied. The results obtained by this method are remarkable. Hoffmann (St. Louis Med. and Surg. Jour., Feb., '96).

Bleeding has gone somewhat out of fashion, but a few Swedish leeches or

the application of a few wet cups will give quicker results than almost any other means. The cases in which one will be inclined to use those means are, however, few. Ordinarily an ice-cap may be applied, but in other cases hot applications, such as woolen cloths wrung out of hot water, or hot-salt bags, or a hop poultice made by heating hops in a pan, moistening them with vinegar and inclosing them in a bag, or even the use of the ordinary rubber hot-water bottle.

Personally I am partial to the use of the splint and ice-cap, and then when the pain and tenderness have somewhat subsided light massage may be employed. Massage is not used to anything like the extent it deserves. Employed daily very lightly at first and afterward more firmly, I am convinced of its great efficacy.

Obstinate cases of subacute and chronic synovitis I am convinced are best treated by absolute rest, as far as any use of the joint is concerned. The disease is often kept alive and troublesome because the patient persists in using the joint to the extent that the pain will allow him to. Massage is not incompatible with rest, but violent passive motion is. Therefore the joint may be rubbed to keep up its circulation and nutrition, but not irritated by bending. Hot-air baths are likewise of the greatest service to remove stiffness.

> Six cases of chronic synovitis treated and cured by massage. The *séances* were repeated once daily, lasting each time from fifteen to twenty-five minutes. Greidenberg (Sei-I-Kwai Med. Jour., Oct., '89).

The question of tapping a distended joint to remove the effusion is an important one. I do not believe it correct to say that the procedure is without danger. On the contrary, it should be done in the most careful manner, or else the joint is apt to be infected and a serous effusion changed to a purulent one, with a possible disorganization of the joint. To properly tap a joint, the first thing is to get a sharp trocar the cannula of which is so closely fitted as to allow it to pass through a piece of leather without catching. Very few trocars stand this test, and all others are positively dangerous. It should be thoroughly disinfected—preferably by boiling. The part should be likewise thoroughly cleansed by scrubbing and antiseptics, the same as for any other serious surgical operation. The surgeon's hands also require the same careful treatment. After tapping, the opening should preferably be sealed with collodion and gauze or cotton. If a bandage is applied with a dressing, the greatest care should be taken that it be so large and so firmly secured that by no possibility can it become displaced and the puncture exposed. Tapping done in this manner is of great service and not accompanied by much risk,—personally I have never had the slightest bad effects from it, but make it a positive rule to observe the greatest precautions against introducing infection.

Stiffness following synovitis, in which pain is not marked, may be treated by persistent, but not violent, passive motion and massage. If this is not successful, then a free movement of the joint under an anæsthetic may be tried, followed for a short time by complete rest and the ice-cap until reaction is past, when passive movements and massage, the use of the hot-air bath, the application, perhaps, of iodine to the joint or compression by a rubber bandage may be tried. Chronic joint-affections will tax the skill of the most experienced, and the surgeon must call on his ingenuity to devise means to achieve success.

Arthritis.

Arthritis is an inflammation of the entire joint, instead of only its synovial membrane as in synovitis. Clinically the difference is mainly one of degree. An inflammation that begins in the synovial membrane may involve the capsule, the cartilages, and eventually the bones. It is a more serious affection, more severe in its symptoms, more exacting in its treatment, and more serious in its prognosis. It may be started by an injury, by exposure, by infection either direct or by extension from neighboring diseased structures, or by a constitutional cause.

Symptoms.—In arthritis the symptoms peculiar to synovitis are more marked; the fever is high if the disease is acute; the constitutional disturbance is severe; the swelling is marked; œdema may be present: the joint tender, particularly on its surface, as well as deeper in; it is flexed and rigid; the atrophy of the muscles is rapid; if it is moved grating may be heard, owing to destruction of the cartilage; and, as the disease advances, sinuses may form, bone may exfoliate, and even dislocations occur, with total disorganization of the joint. Sometimes the disease necessitates amputation or causes death. Often its course is very rapid. Infants are particularly liable to a form caused by extension of inflammation from the adjacent epiphysis, and it is productive of the most serious results.

Seventy-one cases of acute arthritis in infants, 45 per cent. of which died. In 52 cases but one joint was affected,—mortality, 34 per cent. In 15 cases more than one joint was involved,—mortality, 75 per cent. Disease regarded as an osteomyelitis, due to the staphylococcus pyogenes aureus, and most frequent during the first year of life. Dubreuilh (Revue d'Orth., Sept., '90).

Auscultation in joint-disease quite as useful as in affections of the lungs. Normal, very little derangement within the joint, giving no pain, leads to abnormal sounds, increasing in degree as the impediment is intensified. Five joint-sounds: (1) simple, dry friction-sound; (2) dry grating sound; (3) coarse grating sound; (4) moist crepitant sound, and (5) coarse, crepitant sound. Sir Benjamin Ward Richardson (Asclepiad, 3d Q., '94-'95).

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Reflex muscular spasm regarded as the one most important sign in chronic joint disease. By it is meant a tonic spasm or contraction of all or some of the muscles in relation to a diseased joint. It is present only in those muscles which act upon the diseased articulation: it is almost without exception the expression of bone-inflammation; it is the first sign to appear, and it persists till healing has taken place. Le Roy W. Hubbard (Amer. Medico-Surg. Bull., Jan. 11, '96).

In children a chronic progressive enlargement of the joints associated with general enlargement of glands and enlargement of the spleen, usually begins before the second dentition, the majority of the patients being girls.

The onset is usually insidious, but occasionally is acute, with rigors. The change in the joints suggests a general thickening of the tissues around the joint rather than a bony enlargement, and there is a striking absence of osteophytic outgrowths even when the disease has persisted for years. Redness and tenderness are present only in the more acute cases; but there is, as a rule, marked limitation of movement. The joints first affected are usually the knees, wrists, and those of the cervical spine. The sterno-clavicular joint was affected in two out of twelve cases, the temporo-maxillary in three. There is no tendency to suppuration or bony ankylosis. Wasting of the muscles which move the affected joints is a striking feature of the disease.

The glandular enlargement is general, but affects primarily and chiefly the glands related to the affected joints. The glands are discrete, firm, painless, and show no tendency to break down.

The enlargement is, to some extent, proportionate to the severity of the disease, and tends to diminish when the condition of the joints improves, and *vice versâ*. The splenic enlargement is observed in a large proportion of the cases. It bears some relation to the degree of enlargement of the glands.

Valvular disease is not met with. Anæmia of moderate or slight degree usually observed. In some instances there is slight continued pyrexia. Sweating is often profuse and bears no relation to the temperature. Arrest of bodily development is usually present, but the mental powers are in no way impaired. The progress of the disease is slow, and in time it tends to become stationary. Death, when it occurs, results from complications. G. F. Still (Medico-Chir. Trans., vol. lxxx, p. 47, '97).

Treatment.—The treatment of arthritis in its mild form is practically that of synovitis, which has already been detailed at length. It is, in the highest degree, desirable that the serious character of the affection be recognized as soon as possible, in order that more rigid precautions may be taken than would be considered necessary in synovitis. It is more justifiable to resort to severe measures. The consequences of an arthritis are almost sure to be some limitation of the usefulness of the joint; not seldom does total stiffness ensue or the suppuration may be so marked as to demand resection or amputation to save life. If the disease is acute absolute rest in bed with the limb on a posterior splint (if knee is affected) is to be enforced, with the application of leeches, wet cups, or ice. Sometimes it is desirable to apply adhesive-plaster extension with weights. The amount of weights used is to be gauged by the patient's feelings. In the hip-joint particularly extension is necessary. In the ankle and shoulder plaster-of-Paris fixation-splints are of service, because in those joints movements are most apt to be marked.

In addition to rest, the employment of prolonged, properly graduated, dry refrigeration of the joints advised. Gerster (Annals of Surg., Apr., '88).

Acute inflammations are rapidly cured by the salicylates, with aconite or digitalis for the liquefacient and depressant indications. Illingworth (Collaborator of the Annual, '90).

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In treatment of injured and diseased joints massage, with passive motion, indicated. Personal belief in commencing the massage immediately. The massage, beginning at the periphery and then extending to the joint, is not painful, and acts to remove the extravasated fluid which is the cause of the trouble. After the massage the joint is placed in a compressive cotton dressing, fixed upon a splint and placed in an elevated position. The massage is continued in daily sittings. After three or four days the splint is removed, and after the disappearance of the swelling passive motion is commenced, while the use of the joint is fully restored at the end of fourteen days. The time at which passive motion should be commenced is of great interest. It has for its purpose the prevention of atrophy in the soft structures of the joint and in the group of muscles which moves the limb.

In the elbow passive motion should be commenced on the third or fourth day. In giving the passive motions the Swedish method is employed, where the patient offers a slight muscular resistance to the motion. Gonorrhœal arthritis and those forms of arthritis which occasionally appear in typhoid, measles, scarlet fever, small-pox, dysentery, and diphtheria, advised to be let alone. Massage especially warned against in gonorrhœal arthritis. Massage advocated in cases of arthritis due to fungoid tubercular granulations. Klemm (St. Petersburger med. Woch., No. 28, '97).

Cartilage in a healthy state is not sensitive, but when a joint becomes inflamed any pressure of the joint-surfaces together is productive of great pain and

increases muscular spasm. Should the inflammation continue increasing, the joint should be tapped as described under the treatment of synovitis; instead, however, of merely allowing the liquid joint-contents to escape, the whole joint should be washed out. For this purpose sterilized salt solution, a saturated solution of boric acid which has been boiled, or a weak bichloride-of-mercury solution, 1 to 3000 or 1 to 5000, may be used.

> In cases of knee-joint irrigation we do not hope to do more than to greatly inhibit the activity of the micro-organisms —to assist the tissues to destroy the micro-organisms. That solutions of bichloride of mercury are more efficacious than salt solutions in destroying and inhibiting pyogenic organisms outside of the body we have sufficient proof. Halsted (Johns Hopkins Hosp. Bull., Dec., '95).

If the inflammation increases and pus forms, then the joint will have to be drained. Drainage of the various joints is not apt to be a very satisfactory procedure. This is on account of there being no empty spaces for the drainage-tube to lie in. The bones touch each other and the interspaces are filled with the synovial fringes, while all are closely embraced by the capsular ligament. The knee-joint is the one most commonly treated by drainage. One of the best methods is to pass a tube into the joint just below the patella and to the inner side of the median line. It is then carried between the condyles and made to emerge posteriorly to the outer side of the popliteal vessels. Another way is to insert one on each side of the patella and another well back in the joint from side to side. The joint, however, is such an intricate one that good drainage is very difficult, and if the disease increases something further may have to be done. The choice will lay between amputation or resection and some form of arthrotomy. The recuperative powers of childhood are so great that conservatism is far more judicious than is the case in youths and adults. In young children partial procedures are often preferable to more radical ones. Resections in them give extremely bad results on account of the interference caused with the growth of the limb. The disability and deformity which at the time of the operation may have been comparatively slight can become so severe as to make a subsequent amputation desirable. Amputations are resorted to only as a means of saving life in children, but in adults the probability of a good result after very extensive bony disease is so slight that in them amputation is justifiable where in a child resection would suffice. In adults, also, resection of a joint is resorted to earlier than in children. If a marked purulent arthritis once becomes established in an adult resection is often demanded, and it is not advisable to defer operating until extensive disease of the bones is present. After pus once forms in the joint of an adult the joint is very apt to remain stiff even if cure occurs, whereas the result after a resection is no worse and the course of the disease is much shortened. One does not have to fear subsequent deformity due to the disparity in growth of the two limbs. In very young children formal resections may give way to atypical operations, in which the disease foci are gouged away and even some cavities deliberately cleansed out and packed with gauge and left to granulate. Even these partial operations should not be undertaken until the disease is marked.

> Twenty-eight cases of operations upon joints in which the joint was opened, and in but one was subsequent amputation found necessary. Bruce Clark (Illus. Med. News, Dec. 14, '89).
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> Astragalus which had been removed

during an operation for arthritis of the ankle and placed in a 0.6-per-cent. lukewarm chloride-of-sodium solution successfully replaced. Paulsen (Dublin Jour. of Med. Sci., Feb., '90).

Drilling into the bones in the neighborhood of inflamed joints and injecting carbolic acid, 1 in 40, recommended, thus relieving pain and hastening recovery. N. Smith (Brit. Med. Jour., Feb. 22, '90).

The failure of general health is the best indication for operative procedures. In children up to the age of about five years even free suppuration of a joint may often be cured without severe operations. A great deal depends on the mechanical ability of the surgeon to handle these cases conservatively.

Arthrectomy, or erosion, is the scraping, or curetting, of the joint with the removal of the synovial membranes as much as possible. Its results have not been so brilliant as was anticipated. The procedure will probably be followed by stiffness, and the likelihood of cure is not so great as if a formal resection is done. It is most applicable in children of an age unsuitable for resection. In them accompanied by a free use of the curette for the removal of disease foci in the bones it is the operation of choice. As one approaches adult age so does its desirability lessen.

Treatment of Chronic Cases.—Arthritis not infrequently pursues an extremely chronic course. Its treatment is to be varied according to the diathesis present. Thus syphilis or rheumatism or other constitutional affection should receive the constitutional remedies appropriate to them in addition to the local treatment. Many arthritic cases are kept in a chronic condition by the inability or indisposition of the patient to keep the joint sufficiently long at rest for a cure to be effected. I have frequently seen joints improve after other methods had been tried when absolute rest in bed was enjoined. This rest should be insisted on until all evidences of activity of the disease have ceased. The joints of the lower extremities are the ones most often affected, but those of the upper are likewise attacked. When the wrist is involved the hand and forearm up to the elbow may be enveloped in a plaster-of-Paris or preferably a silicate-of-soda bandage. Another convenient way of fixing the wrist is by means of leather. A piece of harness or not too heavy sole-leather is obtained, and two pieces cut of a size suitable to reach from near the elbow to the metacarpo-phalangeal joint and each half way around the arm. They are then to be soaked in warm—not hot—water and applied to the arm; with a penknife a space is cut for the thumb and the splints shaped to fit the hand and forearm. The edges may be shaved thin so as to allow of overlapping. With a bandage the two pieces of leather are fastened firmly on and allowed to remain until the next day. They will then be found to be hard when they can be removed, lined by pasting chamois-skin on the inside and the two splints fitted either with straps or eyelit holes for lacing. Over the affected joint a piece of lint spread with belladonna and mercury or ichthyol ointment may be spread or it may be painted with iodine or treated in any way desired. The use of the local hot-air baths is very desirable in arthritis arising from traumatic or rheumatic causes, but not in tubercular ones. This is likewise true of electricity and massage. These hot-air baths should be carefully watched to see if their effect is suitable to the particular case, for not infrequently they aggravate instead of alleviate the trouble.

For stiff and sprained joints, the limb with the affected joint is placed in an

appropriate box and the temperature gradually and yet rapidly raised from 240° F. to 280° F., and even, in some cases, to 300° F. This temperature is maintained from half an hour to an hour. The treatment is not uncomfortable, although the skin becomes very red and moist. The results are very satisfactory, some of them being almost marvelous. Alfred Willett (Clin. Jour., May 30, '94).

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Hot air is almost always followed by good results; but in one case there was much inflammation about the joints and success did not attend the treatment. Alice M. Seabrooke (Phila. Polyclinic, July 30, '98).

Very good results following applications of hot air for about an hour, the temperature being brought up to about 250°, and in some cases to 300°. The structures about the joints are much softened by such treatment, and yield to forced stretching. J. T. Rugh (Phila. Polyclinic, July 30, '98).

When any one of the three large joints of the upper extremity is affected the hand should be carried in a sling.

When the elbow or shoulder is to be treated the silicate of soda probably makes the best splint-material. It would be far more popular than it is if the method of its use were better understood. The secret of success is in first having the bandages thoroughly impregnated with the silicate, and, secondly, in not applying too much silicate while making the splint.

If gauze or scrime or crinoline is used, then it is easy enough to have it thoroughly soaked with silicate, but with cotton bandages a certain amount of silicate should be placed in a basin and the bandage allowed to pass through it as it is wound by hand. A convenient machine for the preparation of these bandages is one I have been using for years. It consists of a V-shaped box into which the silicate is poured. The bandage goes over the edge of the box down under a rod at the bottom and up to be wound around a small handle, or winch. In applying these bandages the part is first covered in the same manner as for plaster-of-Paris. All surplus silicate is squeezed from a bandage, and it is then applied. After a couple of layers, strips of tin are laid on and covered by a couple more layers of bandage. These tin strips should always be used in dressings of any size, as they prevent the bandage's becoming wrinkled, and keeps it in shape until properly hardened, and also adds somewhat to the strength of the apparatus. Additional silicate is *not* to be smeared on over the various layers of bandage. The hand should be moistened with warm water and the bandage smoothed therewith. Made in this manner, the bandage will take about twenty-four hours to dry, and will get as hard as a stone and yet be extremely light.

It may be made removable by cutting down with a knife and inserting hooks or eyelets. If hooks are desired, the large size may be bought at any dry-goods-store and these sewed to the folded edge of a strip of unbleached muslin. This is then pasted along the cut edges of the bandage with additional silicate and left for another twenty-four hours to dry. The bandage if applied for disease of the elbow should be carried well up toward the shoulder and down toward the wrist. If this is not done too much motion is allowed at the joint. When the shoulder is affected the arm is to be confined by the dressing to the body to prevent its swinging. In the treatment of chronic joint diseases orthopædic apparatus can often be used to advantage. Thus in disease of the elbow-joint a useful form is composed of two side-irons with a joint opposite the elbow, which is capable of being so regu-

lated as to allow a little or no motion as is desired. The two side-irons are fastened to the arm by two leather sockets, one lacing around the arm above the elbow and the other below the elbow.

Affections of the hip-joint are usually treated by adhesive-plaster extension, from five to fifteen pounds being used; the limb is steadied either by sand-bags on each side or by means of a long, lateral splint.

In walking cases some form of the old Davis or Taylor traction splint may be used. The same object is accomplished by the patient's wearing a high shoe on the healthy limb and using crutches. The affected limb is allowed to hang. To steady it a plaster-of-Paris or silicate-of-soda or other dressing is applied around the pelvis and thigh, down to the knee. The long posterior splint of Thomas is also of service. For the knee one may use an elastic knee-cap or a light plaster-of-Paris splint, or one made of leather, or silicate-of-soda or even pasteboard is suitable. Of whatever material the splint is made, it should go high up toward the hip and low down toward the ankle, otherwise too much motion will be allowed. Thomas has also devised a serviceable apparatus to be used in these cases. It is composed of two side-irons in the form of the letter U. The two upper ends are joined by a padded iron ring and the opposite extremity projects beyond the foot. The patient puts the leg through the ring and practically sits down on it, allowing the leg to hang between the side-irons. A bandage confines the apparatus to the limb. Other forms of apparatus are also of service. Thus, one can be made with two side-irons which are jointed opposite the knee-joint. At least one of these side-irons goes down to the foot and is fastened to a steel sole-plate. If this is not done, it will be found almost impossible to keep the apparatus from sliding down. The amount of motion to be allowed is regulated by altering certain stops at the knee-joint. Many of these knee cases can be allowed a certain amount of motion with benefit, because it is only when the motion is excessive or takes place in some unusual direction —as twisting—that it is harmful.

For the ankle, silicate-of-soda, plaster-of-Paris, or leather supports are needed. In light cases the elastic-webbing bandage or Martin's rubber bandage gives considerable support. If it is desired to keep the joint quiet, then the dressing should extend well out toward the toes and well up toward the knee. For more permanent use a steel sole-plate may be inserted in the shoe, and from it two side-irons go up the leg. There need be no ankle-joint, as the patient can walk quite well, even with the ankle stiff. An apparatus can be constructed on somewhat similar lines to go inside the shoe, and thus can be worn with different shoes.

Rheumatic Arthritis.

Rheumatic affections of the joints do, at times, claim the attention of surgeons. Rheumatism in an acute form comes under the care of the physician, but not seldom it assumes a chronic form and becomes localized in a joint and produces such disability as to require special local treatment, and then the surgeon is called upon. It is a strange fact, although one perfectly well known, that an injured part is more liable to become affected with rheumatism than one previously healthy. Patients who have suffered comparatively little, except slight pains in various parts of the body, may, after the reception of an injury, have a distinct rheumatic inflammation, in a subacute or chronic form, affecting the

injured part. Any physician who sees general injuries or affections of the joints is certain to be called upon to treat cases in which the rheumatic element plays a more or less conspicuous rôle. The disease in an early stage may be only a synovitis, with serous or serofibrinous effusion into the joint; if, however, the attack is exceptionally severe, especially in duration, the whole articulation becomes involved. The serofibrinous effusion may be abundant and not confined to the joint, but involve the capsule, ligaments, and periosteum, and even extend some distance into the surrounding structures. The cartilage also suffers, and it becomes roughened and may even be worn off, leaving, in places, the bone exposed. The effusion may be of a plastic character that will bind and mat the various structures of the joint and its neighborhood together, thus producing a fibrous ankylosis. Calcareous salts may be deposited in this exudate, producing an exostosis, which causes a bony ankylosis. The periosteum engages actively in this process. It is probable that many cases of arthritis which are regarded as being purely of a traumatic character owe their obstinate course to a rheumatic taint.

> In the majority of cases, loose bodies of mixed cartilaginous and bony nature are wandering osteophytes, and are evidences of a rheumatic arthritis, either manifest or latent. Patterson (Jour. of Anat. of Insanity, Apr., '90).

Symptoms.—The main difference between the symptoms of a rheumatic and simple arthritis is that those of the former are far more painful both to the touch and also to movements. Not infrequently the signs of inflammation run high, and then the joint looks red. When, however, the course is more subacute or chronic it possesses a dead, milk-white look that is highly characteristic. Even when of this color the sensitiveness may be as acute as ever. Movements cause great pain, and in long-standing cases they are much restricted. Swelling is present, and joints are apt to assume a more fusiform shape than is the case in a simple arthritis. Œdema may also be present. Certain portions of the joint may be more affected than others. Thus I have seen the knee swelled at the side and above the patella and the shoulder at its anterior part. In some of these cases the adjoining bursæ may also be affected.

Treatment.—In addition to the measures generally used for simple arthritis those appropriate for the rheumatic diathesis must also be employed. (See RHEUMATISM, volume v.)

> For purposes of treatment, rheumatic arthritis should be carefully differentiated from rheumatoid arthritis. The former is an affection of rheumatic origin, local in character, in which the neural element is absent. The latter is a general disease of debility, having no connection with rheumatism, in which the neural element plays a conspicuous part, and which occurs in cases with strong hereditary histories of gout, struma, or phthisis, its last stage being osteoarthritis. Hugh Lane (Lancet, Dec. 10, '92).

It is important to bear in mind that the joint is to be protected from disturbing movements. It is here that rheumatic differs from simple traumatic disease of the joints. In the latter a small amount of movement may not be painful, but in the former the opposite is the case. Massage is not apt to be of service except in chronic cases, certainly not in acute ones. Rest on a splint is to be enforced, with the joint wrapped up in cotton or flannel. The application of cloths wrung out of hot alkaline solutions may be tried. A piece of lint wet with chloroform liniment and covered

with woolen cloths may give relief. Osler advises the use of the Paquelin cautery, lightly and rapidly stroked over the part, as a means of reducing pain. The use of leeches is not so efficacious as in traumatic cases. Cold applications are only to be advised when not distressing to the patient. The use of hot-air baths must be decided by a cautious trial. The heat at first should not be great, and in many cases, particularly acute or subacute ones, local hot-air baths are not to be used at all.

Literature of '96-'97-'98.

Attention called to an apparatus employed in a series of cases in the University Hospital, where some three hundred baths were given to test its efficiency. It was found to be most satisfactory. The cases that were treated included acute and chronic articular rheumatism, gonorrhœal rheumatism, gout, traumatic arthritis, synovitis, tenosynovitis, and fibrous ankylosis.

The method of administering the bath is as follows: The patient's pulse and temperature are first taken and recorded. The limb, first being completely enveloped in a piece of lint, which is wrapped loosely about the part, is then placed in the cylinder. The time allowed for each bath is from three-fourths of an hour to an hour. At intervals of twenty minutes the door of the cylinder is thrown open momentarily to allow of the ingress of a fresh supply of air. If the patient perspires freely, this opportunity is taken advantage of to wipe the limb thoroughly dry. If this precaution is not taken and the limb is allowed to remain bathed with sweat, there is the possibility, if the temperature is exceedingly high, of a superficial burn's resulting.

The degree of temperature employed varies, some patients bearing with perfect comfort a degree of heat which would be extremely painful to others. The average is about 300° F. The frequency with which the baths are given varies with the severity of the case; usually, however, they are administered on every other day.

Permanent cures of local lesions, symptomatic of diathetic diseases, are not to be looked for from the employment of hot-air baths, but for the relief of joint-affections of traumatic origin this method of treatment is most useful and sometimes indispensable, and the results obtained can be called permanent. C. H. Frazier (Annals of Surg., Oct., '97).

Case of chronic rheumatic arthritis treated for a period of six months with hot-air baths. The patient, a man of 27 years, had a severe attack of rheumatism three years before coming under notice, which lasted for five months. He was left crippled and bedridden with crooked spine, stiff arms and hips, and tucked-up knees. For three years he was practically bedridden. Six months' treatment with gentle massage, iron, and arsenic improved him a little, but he was still unable to walk or even feed himself. At the present time he can walk well, dress and feed himself, and has increased four inches in stature. The baths given were the ordinary blanket baths heated by means of spirit-lamps under a cradle in bed. Short (Birmingham Med. Rev., May, '98).

General hot-air baths and also Turkish baths are far more apt to be of service in all cases.

Literature of '96-'97-'98.

In treatment of arthritis by hot-air baths the patient lies in bed. The tent which covers him is made of two large cradles, covered first with blankets, then with mackintosh sheets, and then again with blankets. The coverings must be arranged at the top of the tent in such a manner that a small opening can be made to let out the hot air when it has become saturated with moisture. If the packing be too tight, a counter-opening must be made. The patient's neck should be wrapped as air-tight as possible. The cradles used are made of wire netting on a metal frame. The flue attached to the lamp passes through an opening in the blankets at the foot of the tent, and may be covered with asbestos or a wet cloth to protect the blanket. The lamp should be made without solder. The blanket which has cov-

ered the body is removed finally to allow of free evaporation from the surface of the skin. The patient is wiped down after the bath, and wrapped in dry blankets for the rest of the day.

As a rule, an opening need not be made till the patient breaks out in a good perspiration or complains of feeling too hot. The opening should be made at the top of the tent. This is the important point in the treatment.

This treatment is applicable to:—

1. Subacute rheumatic arthritis.

2. Subacute arthritis following acute rheumatism, or rheumatoid arthritis, associated with pain and stiffness on movement, with continual aching pains.

3. Impaired mobility following injuries to joints or to muscles in their neighborhood, and cases of joint-trouble from trophic causes or disuse. T. Sydney Short (Brit. Med. Jour., Nov. 26, '98).

Too vigorous local treatment is very apt to relight the trouble; coaxing, and not forcing, is our motto. This is true also of passive motion. What is gained by gentle persistent motion is apt to be retained, but what is acquired by forcible movements under anæsthesia is apt to be lost and the joint remain stiffer than before. Notwithstanding the assertion of Treves ("System of Surgery," volume i, page 267), that rheumatism and gout have practically no effect on the immediate future of an operation, care should be exercised. In disabilities resulting from loss of motion in joints partial operations are liable to be extremely unsatisfactory, and only start the trouble anew, as I have seen, and the total removal is more satisfactory. Thus, in the elbow-joint a formal incision is apt to give a better result than the removal of exostoses. In one case I deliberately excised the joint of the big toe for an intractable rheumatic inflammation that had lasted over a year, resulting in partial disorganizing of the joint. While it is possible that rheumatism may, at times, have a septic element in it, the practice of tapping and washing the joint with a mild antiseptic solution is only to be followed with caution and in selected cases.

As a treatment for chronic rheumatic arthritis it is advised that the patient be chloroformed, the joints freely and fearlessly moved, and the flexors and extensors roughly massaged. Collins (Brit. Med. Jour., Apr. 19, '90).

Literature of '96-'97-'98.

Heroic treatment of acute rheumatism by means of opening and draining the affected joints advocated. Operation should be performed as soon as one joint is definitely affected, in order to save other joints and the endocardium. General toxæmia disappears when the affected joints are irrigated and drained. The incision into the joint must be large enough to admit the index-finger in order to remove the coagulated lymph. Irrigation with 1 in 5000 solution of biniodide of mercury and potassium is best. The joints should be dried with a long roll of gauze in order in drying to remove all flocculi. The joint should be drained by a gauze drain. J. O'Conor (Annals of Surg., Feb., '98).

Gout, Arthritis of.

Gout is certainly less common in this country than abroad. On this account it may not be recognized at first sight. It attacks all the joints, but most frequently the metacarpo-phalangeal joint of the big toe. It may present itself in an acute form, affecting only one joint, or in a more chronic form. This latter is usually preceded by the former. So that the chronic form of the disease may be largely the remains of several acute attacks. The changes produced in the parts are marked, as is also at times the resultant disability. The cartilages are apt to be first attacked and then the surrounding structures. Urate of soda is deposited in the joint on the articular

cartilages and through them, in the capsular ligaments, and even surrounding tissues. To such an extent is this latter the case that gouty nodules of urate of soda deposited on the knuckles not infrequently ulcerate through the skin.

Literature of '96-'97-'98.

Statistics of the location of the pain in cases of gout and rheumatism occurring in Roosevelt Hospital.

In all diarthritic joints the painful points in gouty inflammation were, with certain specific exceptions, on the condyles. In acute rheumatic arthritis, on the other hand, the pain was more diffused, but distinctly pronounced along the tendons, and at their attachments, but not on the condyles. In rheumatoid arthritis there was no uniformity in the localization or tenderness on pressure. In gout the periosteum was chiefly affected, and in rheumatism the substance of the bone. W. H. Thomson (Amer. Medico-Surg. Bull., Aug. 16, '96).

The treatment of an acute attack is to be sedative, but not too depleting. This subject is fully treated under GOUT, volume iii. Surgical measures are rarely required. When the chalky deposits are marked, and, if they are loose, the skin may be incised and the deposit turned out. Care should be taken not to injure the skin over these deposits or it may ulcerate and leave an exceedingly annoying sinus.

Charcot's Disease.

This name is applied to the joint-affections which at times accompany locomotor ataxia. Charcot estimated that they occurred in 10 per cent. of the cases of ataxia, but in this country, at any rate, the proportion is much smaller. The changes produced in the joint resemble to a considerable extent those present in osteoarthritis. The course of the affection, however, is different. There are the same cartilaginous changes, with first fibrillation and then disappearance. There is a marked increase of synovial fluid, bulging out the joint usually more marked than in osteoarthritis, and there are the same ridges of bone, with occasional nodules. The disorganization of the joint is apt to be more rapid and more marked. Whereas a joint affected with osteoarthritis tends to ankylose, that affected with Charcot's disease becomes loose and flail-like. Pain is a marked symptom in the former: In the latter it is only present to any extent in the early stages, to be replaced later by anæsthesia. Even the bones wear away as if from pressure. It usually attacks single joints, but both knees may be affected or the elbow and fingers. At times its course is rapid disorganization occurring in a few weeks, and this independently of the fact of use of the joints. These cases are of particular interest to the surgeon, because he is liable to be consulted before the ataxic disease has been recognized, and their true character is liable to be overlooked. Whenever an adult patient comes with a joint largely distended with fluid, with comparatively slight pain, and with symptoms apparently too mild for the evident destructive lesions present, then one should search for ataxic symptoms.

Possibility of the occurrence of marked joint-lesions before the symptoms of spinal disease manifest themselves to any great extent. Attention called to the close similarity between the joint-lesions of tabes dorsalis and those of syringomyelia; but, while the former disease affects the lower extremities (76 per cent.), the latter confines itself to the upper. Osteomata of the tendons, muscles, etc., are found in both diseases, but more frequently in syringomyelia. If only the local conditions were considered, it would be difficult to differentiate the two affections. The joint-lesions may be divided into the atrophic form, which is rare, and the hypertrophic form, which

is more common. Charcot (Le Prog. Méd., Apr. 29, '93).

Locomotor ataxia manifests itself by inco-ordination of movements, want of ability to balance one's self, especially with the eyes closed, by shooting pains in the lower extremities, also gastric disturbances. The pupils do not react to light, but do to accommodation,—the Argyl-Robertson pupil. The reflexes become lost, there may be ptosis or strabismus, or even a commencing optic atrophy, and as the disease advances paraplegia with loss of control of the sphincters. (See Locomotor Ataxia.)

Treatment.—The disease is practically incurable. When it seems very active complete rest may be enjoined, but when it is slow, then supports may be applied to the joints so that they can be used as long as possible. It is in the highest degree advisable not to subject these joints to operative procedures. It is a great temptation to recommend the removal of a limb whose knee-joint is absolutely disorganized; but doing so may result in the death of the patient, because the attempt at healing may be slight or totally lacking.

Conservative and palliative treatment is to be advised and the joint given all the support possible. Of course, the treatment proper for ataxia is to be given, as well as local attention to the affected joint.

Septic Arthritis.

The joints frequently are attacked by an inflammation of a septic character while there co-exists a septic disease affecting the body generally. This infection is caused by a pus-producing organism, the staphylococcus. Pyæmia, typhoid and other fevers, and the puerperal state are the diseases most often accompanied by septic joint-affections.

Inasmuch as the condition is much the same in all, they present, to a great extent, similar symptoms. The joint becomes the seat of an effusion, usually with pain. Sometimes only one joint is affected. When such is the case it is apt to be a large one, as the knee or hip. This is frequently the case in puerperal, typhoid, and other fevers. In pyæmia several joints are apt to be attacked. The onset is liable to be very insidious and may be passed unnoticed, being masked by the symptoms of the general affection. The pain in the joint may produce a restlessness which may be attributed to nervous or other disturbance; so that the disease may be far advanced when recognized. Sometimes the local disease progresses with great rapidity, pus being present in the joint almost from the first.

Literature of '96-'97-'98.

Although acute arthritis and epiphysitis occur most frequently and most typically in infants under a year old, practically the same condition is observed in much older children. In the latter an epiphysitis is less likely to cause suppuration of the joint, or, if it does so, this occurs later. The disease frequently proves fatal in three or four days, and the knee is more frequently affected than any other joint, being followed in frequency by the hip, and then the shoulders. The primary lesion is an osteomyelitis, situated in the growing bone at the extremity of the diaphysis, and in close proximity to the epiphysial disk. Therefore separation of the epiphysis frequently follows, and an abscess occupies the epiphysial line. In older children a precisely similar lesion in the neighborhood of the epiphysial line may give rise to the condition known as acute necrosis or acute periostitis. The septic products make their way between the periosteum and the bone, the former being stripped off for a longer or shorter distance. Eve (Clinical Journal, Oct. 13, '97).

The joint swells and effusion is usu-

ally easily diagnosed. On the contrary, the first symptom may be pain. Pain is a very constant symptom of general sepsis and pains in various parts of the body may be complained of before any definite joint disease is visible. The color of the skin over the joint is not apt to be changed at first; but, if disorganization of the joint takes place, then it may become red and œdematous. In the hip-joint, which is exceedingly liable to become affected in typhoid fever, dislocation is very apt to occur. If the hip trouble occurs early in the course of the general disease, it may, as in one case in my own experience, be difficult to diagnose the condition from acute hip disease of a tubercular character. Multiplicity of lesions always argues for a general infection; therefore, when more than one joint is affected, one is almost sure that the disease is only a local manifestation of a general condition instead of being a distinct and separate local disease. Oftentimes if the general disease tends to recovery the local joint trouble may be more of the nature of a synovitis than an arthritis, and may pursue a mild course, particularly if only a single joint is affected. If, however, the general disease is grave the local disease is of a purulent character almost from the start, and suppuration may persist a long time, until death finally ends all.

Treatment.—At the onset of the joint trouble measures should be taken to soothe the irritation of the joint and protect it. It may be surrounded with cotton, or lint wet with lead water, and supported by leather or pasteboard splints. Sand-bags may also be placed on either side and an ice-cap laid on the joint. Sometimes enveloping the part in hot cloths is most comfortable. A conservative course should be pursued as long as the disease is not progressing too fast. If it assumes a chronic form the joint may be wrapped in lint spread with belladonna and mercury ointment or one of 10- to 20-per-cent. ichthyol, and supported by a firm bandage and splints. If, however, the joint-symptoms become very active, it should be aspirated and washed out with sterile salt solution or boric acid or weak bichloride solution.

> Case of acute suppuration of the knee-joint treated by a thirty days' continuous irrigation with a weak solution of boric acid, a good and movable joint being secured. Treves (Brit. Med. Jour., July 7, '88).
>
> Case due to suppurative inflammation of knee-joint. Motion completely restored by daily use of apparatus consisting of weight and rope, latter attached to ankle. Bradford (Med. Rec., June 8, '95).

If suppuration becomes marked, free incision with drainage may be necessary.

In these cases free stimulation to support the general strength is of the greatest importance, because they are liable to last quite a long while and eventually kill the patient by gradual exhaustion.

> In suppurative conditions of the wrist and in compound ganglion relief afforded by subcutaneous division of the anterior annular ligament. Stillman (Bull. Gén. de Thér., Mar. 8, '90).

Syphilitic Arthritis.

Syphilis attacks the joints the same as it does other tissues. It may occur in infancy, from heredity, in the secondary stage, or in the tertiary. In infancy, as well as to a somewhat less extent in adults, the disease is to be diagnosed and recognized not so much by its own peculiarities as by its surroundings and associations. If there is any point that may be more noticeable in it than in other affections of the joint, it is its less acute and less painful course. In infancy the joint, particularly the knee, may become swelled and somewhat—but

not exceedingly—painful, nor very red, but be held stiff, and accompanied by atrophy of the muscles. There is usually present other manifestations of the disease, such as skin eruptions, eye affections, notched or pegged teeth, etc. A syphilitic history may also often be traced in the parents. As I have seen it in infancy it assumes mostly the synovial type and yields to specific treatment. The disease also attacks the joints in the secondary stage. It then shows itself as an effusion into the joints, resembling very much rheumatism, but not in a highly-acute form. One's attention to its true character will probably be attracted by the other secondary symptoms. The disease of the joint will assume a mild acute or a subacute form. In the tertiary stage of syphilis the joint disease is manifested by a deposit of gummatous tissue in the various parts of the joint. The swelling may be more irregular than in rheumatic disease, from the deposit's occurring in some portions of the joint while other portions are free. As a rule, it does not occasion suppuration, although ankylosis may occur. This may be fibrous or even bony.

Syphilitic bursitis may be met with in connection with secondary or tertiary lesions. Buechler (Med. Monats., Aug., '89).

During the last year and a half 328 cases of joint-inflammation personally observed, of which 6½ per cent. were syphilitic in origin. The capsule in syphilitic inflammation of joints often becomes hardened in spots, and lacks the uniform, doughy feel of tuberculosis. Nocturnal pains noticed in syphilis. Rubinstein (Inter. klin. Rund., Sept. 28, '90).

Secondary syphilitic arthritis may present itself in three forms: (1) arthralgia giving rise to no apparent lesion: (2) subacute arthritis; (3) hydrarthrosis. The duration of the disease is short, not exceeding two weeks, and there is no involvement of the heart or the viscera. Cheminade (Ann. de Derm. et de Syph., July 25, '88).

Following division made of joint-syphilis: 1. Synovitis, during the secondary stage. This usually occurs within a few months of infection, is of but short duration, is very amenable to mercurial treatment, and clears off, leaving no trace behind. It is rarer and of far less importance than the other forms, which all occur during the tertiary stage. 2. Perisynovial gummata. 3. Arthritis due to osseous nodes or gummata in the neighborhood of the joint. 4. True chronic synovitis. 5. Syphilitic chondroarthritis (Virchow). To the above forms are added two others, as occurring in hereditary syphilis: (6) syphilitic epiphysitis and (7) chronic effusion into the joints, usually the knee, and almost always associated with interstitial keratitis. Hutchinson (Brit. Med. Jour., Apr. 16, '92).

In syphilitic arthritis there is but slight functional disturbance of the joint, and the prognosis is generally a favorable one. Kirmisson (Le Bull. Méd., May 29, '89).

Treatment.—If the true nature of the disease is recognized, antisyphilitic measures are to be employed. In infancy mercurial inunctions are best. In adults inunctions are desirable if it can be made convenient to use them,—if not, then internal medication. The biniodide of mercury beginning with about $^1/_{24}$ grain and rapidly increasing to a quarter or more three times daily is my preference. The green iodide of mercury $^1/_4$ grain three times daily or a mixture of bichloride of mercury and iodide of potassium or sodium in compound syrup of sarsaparilla are also favorite forms of medication. In doubtful cases iodide of potassium or sodium should be given, as it is likely to be of benefit whether the case is one of syphilitic or rheumatic origin. Locally the methods used for other forms of arthritis are to be used, but the joint may be covered with lint spread with belladonna and mercury ointment.

Tubercular Arthritis. (See also Hip-joint Disease, volume iii.)

Tubercular arthritis is the name given to what was formerly known as scrofulous or strumous disease of the joints. When the knee-joint was affected, it was called tumor albus; it has also been called gelatinous arthritis. It is now positively known that the characteristics of this disease are due to the tubercle bacillus, and that in its pathology it is a true tuberculosis affecting the bones and joints. The tubercular process is a local one: it may and often does occur in company with other tuberculous manifestations elsewhere, but it is late in the course of the disease. The tubercle bacillus becomes disseminated and starts up tubercular processes elsewhere.

In the commencement, the joint, or the adjacent bone, alone is affected. The part becomes infiltrated with small cells, giant cells form; caseation, pus, and necrosis forms; and the bones become destroyed and the joint disorganized. The origin of the disease process is of the greatest importance. Cases occur which look clinically as if the joint alone was involved; as if it was the seat of a tubercular synovitis and that alone. In other cases it is evident that disease of the bone is present, as well as of the synovial membrane. Almost all surgical authors describe these two forms of joint-tuberculosis. Most of them regard the osseous form as being the more frequent, but also that the synovial form is very common.

Recently Edward H. Nichols, of Boston, read before the American Orthopædic Association an elaborate paper on joint-tuberculoses, and he states as his opinion that primary synovial tuberculosis is exceedingly uncommon, and that of 120 tubercular joints he has not seen one in which on sawing open all the bones in thin layers one or more old bone foci were not found. I am inclined to believe that he is right in his opinion and that those joints which have been examined and pronounced to be synovial tuberculosis would have showed in most cases to have bony involvement if the bone had been examined in a number of thin sections. Whatever the true pathology of tubercular joint diseases is, they certainly manifest themselves clinically in the two forms.

Symptoms.—Joint-tuberculosis, while essentially a chronic affection, still sometimes runs an acute course. When it does so, it may exhibit all the signs of inflammation,—viz.: heat, redness, swelling, pain, and disturbance of function. Commonly, however, the disease begins insidiously. Disturbance of function is apt to be the first symptom, particularly if the hip or knee is affected. The skin orinarily remains white, the joint becomes swelled, due to the swelling of the synovial membrane and increase of fluid. Pain begins gradually, and, while sometimes almost entirely absent, at others is felt only on use of the joint. Redness occurs when pus has formed and is working its way toward the surface. This occurs usually at certain definite spots which break down and form sinuses which lead down to carious bone and in cases of long standing directly into the joint. The pain is felt in the joint itself, in the epiphyseal ends of the bones, and in certain cases in distant parts as the pain along the inner side of the knee in hip disease. As the disease progresses the joint becomes disorganized, pieces of bone exfoliate, sequestra are formed, the general health deteriorates, and in a certain number general tuberculosis ensues and causes death.

Almost any joint can become affected, but the most commonly attacked are the

spine, hip, knee, ankle, elbow, and wrist. The small bones and joints of the foot and hand are also not seldom involved.

Treatment.—Tubercular disease of the bones and joints is not so serious a disease as is that of the lungs. The patients usually recover; but are left in a more or less crippled condition according to the severity of the affection. As so many patients preserve a fair state of general health, while possessing a diseased joint, the local treatment becomes more important than the constitutional. In other words, the best way to improve the general health is to better the joint affection. Attempts to "build up the system" while neglecting the local trouble will only end in disaster. The main element of local treatment is rest. Tubercular attacks often follow injuries. Not only is this so, but the disease is kept active by repeated, slight irritations due to movements and use of the part. Therefore protection is required. The more acute and marked the trouble the more absolute must the rest be. It is practically impossible to secure this when the spine or knee or hip are affected unless the patient is placed in bed. Parents, and even physicians sometimes, think that prolonged rest in bed will be injurious to the general health, but experience has abundantly proved that this is not so, and whenever it is possible to do so the patient should be put abed and kept on his back until all symptoms of activity of the disease have subsided. This should be done for months or even a year or two if necessary. In order to keep small children in bed and to prevent their setting up, it is desirable to fasten them down by means of a towel passed across the chest and pinned fast with safety pins to the mattress. Bradford devised a frame of iron gas-pipe to surround the child and covered with canvas or unbleached muslin. The child may be fastened to this by means of a sort of apron passing across the chest with straps passing over the shoulders. This is useful in affections of the hip as well as of the spine. Extension is of service in diseases of the hip and knee; its object is to keep the joint-surfaces from being pressed together by muscular contraction. Its good effect is at once seen by the diminution of pain. It allays muscular spasm. Even when the patient is allowed to go about, the same object is aimed at by the use of a suitable apparatus.

Literature of '96-'97-'98.

Too much stress cannot be laid on the necessity of early and complete rest for the affected joint in tubercular arthritis. Weight extension continued until all pain and tenderness have long subsided is of most use. When an abscess has formed, there are four possible lines of treatment: First, merely opening and draining abscesses as they form. This is an uncertain method. The second line of treatment can only be adopted when the disease is purely synovial—it consists in the removal of all the diseased synovial tissue, and may be expected to cure that form of the disease. The third method is by excision. Finally, in some inveterate cases, amputation becomes necessary. Gerald R. Baldwin (Clinical Jour., Jan. 29, '96).

Mechanical supports or splints of some kind are of the greatest service. Plaster of Paris and silicate of soda are of great utility. Also splints made of pasteboard or wood or leather. When quick setting is required or frequent changing then plaster of Paris is best. When the patient can remain in bed for twenty-four hours and where quick setting is not required and the apparatus is to be worn for a considerable time then silicate of soda is preferable. For the upper extremity splints of wood, or pasteboard or

leather are applicable; but these various dressings can be used in any part of the body and the choice will depend on the peculiarities of the individual case and the mechanical abilities of the surgeon. These dressings should all be so made as to be removed every day or two, so that the parts can be inspected and bathed and excoriations prevented. In spinal disease when the patient is not fastened down in bed, then it is desirable that the apparatus be worn during the night as well as by day; it insures better rest to the diseased part. Local applications do not play a very important part in treatment. In acute cases evaporating lotions like lead-water may be applied or an ice-cap laid on the inflamed joint. When the disease becomes more chronic, then ointments like belladonna and mercury and 10-per-cent. ichthyol may be used and the joint firmly bandaged with either a flannel or rubber bandage or it may be strapped with adhesive plaster. Sometimes small blisters around the affected spot tend to relieve pain.

Large effusions into a joint may be tapped under the strictest antiseptic precautions. If pus forms, the joint may be washed out with a 1 to 5000 solution of bichloride of mercury. The injection of iodoform and glycerin emulsion 10-per-cent. into and around the joint is spoken of favorably by Senn and others.

Case of tuberculous synovitis of the knee cured by injections of iodoform-oil. Troquart (Jour. de Méd. de Bordeaux, Dec. 22, '95).

Literature of '96-'97-'98.

Treatment of tubercular osteoarthritis confined entirely to intra-articular injections of iodoform. Because of the pain attendant upon ethereal solutions of this product, a mucilaginous emulsion containing 33 per cent. of iodoform, has been used; 5 cubic centimetres of this mixture were employed at a dose.

Injections were repeated twice a week; when improvement was slow every second day. In seven cases the results were very satisfactory. In the eighth case, complicated by suppurating sinuses, resection was necessary; the ninth required amputation. Results were especially good in white swelling of the knee-joint. Five patients treated for this affection were cured in from four to six months, and the cure was permanent. Duplay and Cazin (Revue de Chir., No. 11, '97).

Inasmuch as the diseased process is so often situated in the bone, Macnamara has advocated trephining. I have often drilled the affected bone with numerous holes about three-sixteenths inch in diameter, and it has been of great service. Rarely pus may be found, but usually not. The drilling, however, tends to stop the progress of the disease, and is worthy of more extended use than is now practiced.

The question of operative treatment in tuberculous cases is the cause of much difference of opinion. One fact is well settled, and that is that conservatism is more desirable in orthopædic cases than in those of general surgery. Abscesses may be opened if they pursue an acute course with considerable pain and disturbance of the patient. If they are cold, chronic, and not too large, they are best let alone, as many of them will entirely disappear. Infection is very liable to attack a discharging collection of pus, and the general health may become affected. Abscesses may be emptied with a trocar, washed out with salt solution or weak antiseptic, and then injected with 10-per-cent. iodoform emulsion, an ounce or more being used. This will probably have to be repeated, perhaps two or three times. Sometimes the abscess keeps on discharging without any tendency to heal until death from exhaustion or general tuberculosis supervenes. Resection of joints is to be resorted to when the suppuration is so profuse as to endanger life

and the patient is of a suitable age. Resections in young children interfere so much with growth as not to be advisable. In these, partial resections or erosions are to be preferred, the joint being opened and the affected tissue cut and gouged away. Operative measures are more advisable as the patient increases in age. Amputation is only to be resorted to as a life-saving measure, usually for profuse suppuration with entire disorganization of the joint. As a rule, patients are to be kept in bed until all evidence of acute trouble has gone and remained away for two or three months Then the patient may be allowed to go about with some appliance to keep the joint from moving, or with a high shoe and crutches. These protecting appliances are to be worn for months after all evidence of active disease has passed away. For walking cases very nice appliances may be made of silicate of soda, which can be used for many months. When the patient can afford the expense, an apparatus made by the instrument-maker is much preferable for all of the tuberculous cases. Its style will vary with the character of the case.

General treatment is to be used along with the local. The remedies are well known: codliver-oil with creasote, syrup of the iodide of iron, tincture of nux vomica, and compound syrup of the hypophosphites are those most commonly used. The late Dr. Goodman used a prescription composed of:—

℞ Bichloride of mercury, $^1/_{24}$ or $^1/_{48}$ grain.
Fowler's solution of arsenic, 1 to 3 drops.
Tincture of iron, 3 to 8 drops.
Syrup of orange-flowers, 1 drachm.
—M.

It is a very efficient combination, and acts well in many cases. Careful, persistent, protective, and conservative treatment is the key-note of success in the management of tuberculous joint diseases.

Loose Bodies in Joints.

Symptoms.—The symptoms of the affection are marked, and are due to interference with the function of the joint. The knee is the joint most often affected. The patient, while walking, is apt to experience a severe pain in the joint and may either fall or else hold the joint stiff. It may become locked. In some cases the patient can so manipulate the part as to free the loose body and then walking again is possible. These sudden attacks of disability are followed by a swelling of the joint and all the symptoms of an acute synovitis. These repeated attacks supervening on the original injury are apt to cause the joint to be constantly in a state of low chronic inflammation which is more or less disabling.

> Pain so often associated with the presence of these bodies is largely due to their tearing the capsule in the movements of the joint and not to their being caught between the bones. Riesenfeld (Breslauer Aerzliche Zeit., Jan. 28, '88).
>
> Pain occurring with foreign bodies in the joints regarded as due, not to pinching of the body between the joint-surfaces, but to stretching of the capsule that takes place when the body lies in certain positions outside the joint-surfaces. Larsen (Deut. med. Zeit., Apr. 24, '90).

Besides the pain and stiffness which may be produced, the patient has a continual sense of distrust, which causes him to avoid using the joint freely, and thus interferes with walking. In many cases there is nothing apparently wrong with the joint until the moment of pinching or jamming of the loose body as the joint is in motion. These patients are usu-

ally skillful in finding and localizing the loose body, but not always. Often it disappears on the slightest movement, not to be discovered until it again intrudes itself upon the patient's notice at some inopportune moment.

Loose bodies in joints are usually the result of injury or disease. Many are due to mere masses of fibrin and show little or no structure. Whether simple effused blood can become so firm and compacted as to form loose bodies is questionable; ordinarily such effused blood is absorbed. It is quite probable, however, that some of the milder forms of foreign bodies are of this character. The synovial membrane is, however, a prolific source. Usually as the result of injury the synovial fringes may become inflamed, condensed, and finally separated, leaving the detached body floating free in the joint. This is shown to be the case by some foreign bodies' being covered with synovial membrane. They are not only fibrinous in character, but also cartilaginous. Cartilage-cells are normally found in the synovial fringes, and it is easy to see how an injury could start up sufficient action to form an appreciable lump. Sometimes the bodies are found with a pedicle, by which they are still attached to the synovial fringes. Some of the cartilages may be so severely injured as to be partially or wholly detached or torn off. The fragment then floats free in the joint or if only partially detached becomes parted later on.

Riziform (melon-seed) bodies in tendon-sheaths and joints are not composed of ordinary fibrin, and cannot be considered in any case to be produced by coagulation of the fluid contents of the sac or joint. They are rather products of coagulation-necroses of the internal wall of the sheath or sac. Schuchardt (Virchow's Archiv, Oct. 2, '88).

Affection of knee-joint simulating dislocation of semilunar cartilage. Growth attached to synovial membrane lining capsule, easily removed, derived from synovial fringes. C. Byron Turner (Brit. Med. Jour., Oct. 13, '94).

Literature of '96-'97-'98.

Rare variety of loose cartilage removed from the knee-joint; it consisted of a hard, lipomatous mass affecting the synovial membrane; there were also many smaller similar masses. R. C. Chicken (Brit. Med. Jour., Jan. 1, '98).

The semilunar cartilages are particularly liable to be the seat of injuries. Sometimes a piece of bone is detached along with the cartilage, as occurred in a patient of mine. These bodies not infrequently contain calcareous or true bony matter. In osteoarthritis or arthritis deformans loose bodies are frequent and may exist in great numbers. This is only what would be expected of a disease in which the various cartilaginous and fibrous structures are so extensively affected.

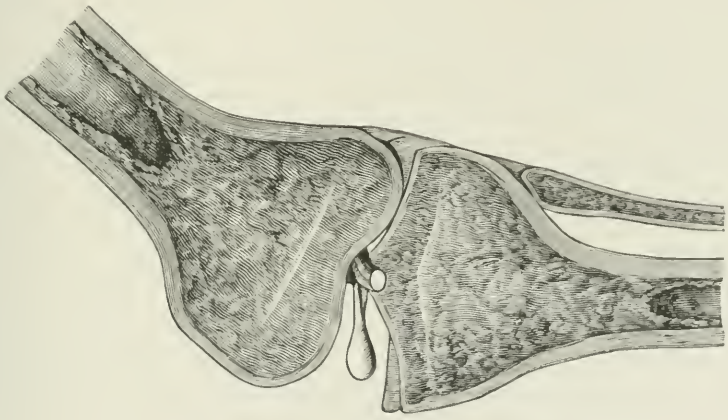
There is usually a clear history of injuries in these cases, to which the origin of the trouble can be traced.

Literature of '96-'97-'98.

The literature from 1883 to 1893 shows that, of 143 cases of floating bodies in the joints in which an operation had been performed, 83 (in 78 of which the knee was the joint affected) were of traumatic, 39 of pathological, and 19 of unknown origin. The injuries which may cause the formation of floating bodies are forced movements, either in normal curves or—which is probably more frequent—in an abnormal direction; and external forces acting upon the articular surfaces or their cartilaginous margins. In some cases forms co-operate. Max Schüller (Centralb. f. Chir., Feb. 29, '96).

Treatment.—In loose bodies traceable to injury removal is, if possible, indicated at once. The procedure which I have found most satisfactory is as follows: The surgeon feels for the loose body, and

when found crowds it into some corner and holds it firmly there with his thumb. Still keeping up the pressure the patient is etherized and an incision made with the other hand down to the capsule of the joint directly over the loose body. A pin is then thrust into it and an incision made directly through the capsule and the body turned out. Special suturing of the capsule is not necessary; two or three deep interrupted sutures to close the wound is all that is necessary. If pressure is relaxed before the pin is thrust into the loose body, it may slip away into the joint and be lost. They cannot be made to appear at will. The favorite places for them are on each side of the patella, especially the outer side and down below and to its inner side. In cases which will not submit to operation, some device may be utilized to alleviate the affliction. A simple elastic knee-cap may afford some relief. Sometimes the body only causes trouble when either excessive flexion or longitudinal rotation of the bones of joint takes place; when this is so dressings or apparatus that limit flexion and to a great extent prevent rotation may be applied. When the loose bodies are the result of osteo-arthritis they are apt to be so numerous as to preclude the giving of relief by an operation for removal.



Loose bodies in the knee-joint. (*Schüller.*)

Analysis of 105 cases of floating cartilages in which antiseptic operations have been performed, with but 1 death. Woodward (Boston Med. and Surg. Jour., Apr. 25, '89).

Absence of danger in free incisions into joints made under aseptic precautions emphasized, in order to remove loose bodies which are firmly wedged between the articular surfaces, without injury to the joint. A limited or external longitudinal incision is made, the leg is bent inward or outward, so as to separate the joint-surfaces sufficiently to remove the body (see figure). If not carried too far, this bending does not injure the ligaments. Schüller (Deut. med. Woch., Aug. 7, '90).

Ten hundred and forty-seven loose bodies removed from a single knee-joint of a man of 22 years. James Berry (Brit. Med. Jour., May 19, '94).

Literature of '96-'97-'98.

The formation of floating bodies may be prevented by immobilization of the joint. When floating bodies have been formed, their removal by operation is strictly to be insisted upon, the more so and the sooner because the disturbance which they cause increases with time.

Max Schüller (Aerztlichen Sachver. Zeit.: N. Y. Med. Jour., Apr. 4, '96).

In foreign bodies in the joints, treatment may consist of wearing an apparatus (such as Marsh's, for prevention of semilunar-cartilage dislocation) to prevent full movement of the joint, and thus avoid the painful locking and injury to the synovial membrane, or, what is incomparably superior when perfect asepsis can be obtained, operation may be performed. In locating the body the local anæsthesia of Schleich is of the greatest value, as the active co-operation of the patient is frequently essential. Attempts to fix the body by a pin before anæsthesia often prove unsuccessful, but if the body can be coaxed to one side of the joint and, while it is held in in its superficial position, the articulation is flexed and held in that position by a bandage at a lower and upper point upon the limb, the body will not only often remain rigidly in position, but will shoot out as a pea from a pod when the overlying capsule is incised. T. S. K. Morton (Phila. Polyclinic, Jan. 25, '96).

Evidence to the effect that where multiple foreign bodies have been treated by operation there has been more or less limitation of motion, whereas in the cases in which there is only one body the results have been excellent. James P. Tuttle (Med. Record, Apr. 25, '96).

Analysis of cases of floating cartilage of the knee treated by operation between 1885 and 1895. The total number of cases considered to have been reported in sufficient detail to warrant attention was 72. Of these 23 were pedunculated and 49 non-pedunculated. Besides bodies detached by slight injury, portions might be chipped off from the ends of the bones as a result of severe injuries.

The majority of the cases were examples of bodies detached by a process the nature of which is as yet unknown. In 1860 the cases occurring up to that time had been collected. Of the one hundred and thirty-five that had been operated upon by direct incision, there were 74.8 per cent. of successes, 21.4 per cent. of deaths, and 3.8 per cent. of failures. Muller, in 1886, had collected one hundred cases with ninety-six recoveries and four deaths. Between 1885 and 1895 no fatal results recorded. Sixty-seven cases tabulated with reference to the function of the joint after operation. It had been found that in 22 per cent. there had been some disability, in 13 per cent. more or less limitation of motion, and in 4 per cent. ankylosis.

Sixty-two out of the 72 cases analyzed in this paper made a complete recovery; in 16 per cent. more or less disability was acknowledged. Of the 10 unfavorable results 6 occurred after the removal of pedunculated bodies, and 4 after operations for the removal of non-pedunculated bodies. Of the 6 unfavorable results 3 were unavoidable from the operative procedures required, and 3 were due to disease existing prior to operation and persisting after it. P. R. Bolton (Med. Rec., Apr. 25, '96).

In operations for loose cartilages in the knee-joint their removal preferred to suture. In all of the twelve cases personally operated upon the functional result has been perfect and the recovery afebrile. Marsh (Brit. Med. Jour., Mar. 5, '98).

Ankylosis.

When from injury or disease a joint loses its function and becomes stiff, it is said to be ankylosed. Ankylosis may be either bony or fibrous. The former has been called true and the latter false ankylosis. In bony ankylosis the bones entering into the formation of the joint have become united by bony tissue. In fibrous ankylosis either the articular ends of the bones are united by fibrous bands going directly from one to the other or else motion is restricted by changes in and around the capsule of the joint. The name is not applied to loss of motion due to changes in structures unconnected with the joint, such as contracted tendons or muscles or cicatrices from burns. All inflammations of joints from whatever cause, if violent enough and long continued, are liable to cause ankylosis. Such affections as destroy the articular

surfaces of the joint are very liable to be followed by ankylosis. Suppuration oftentimes, but not always, results in a more or less complete loss of motion. Serious joint disease almost always results in some loss of movement of the joint, but a certain slight amount may remain; hence one speaks of restricted motion or one may perhaps be allowed to use the term "incomplete ankylosis" to express this condition.

> The question of ankylosis is determined by the severity of the inflammation, the duration of the inflammation, the presence of intra-articular pressure, the subsequent cicatricial contraction of soft parts around the joint, the tissues involved, and the amount of destruction of bone and cartilage. Inflamed joints treated upon the plan of absolute immobilization and the relief of intra-articular pressure furnish by far fewer cases of ankylosis, limited motion, and deformity. Phelps (N. Y. Med. Jour., May 17, '90).

To diagnose ankylosis one must exclude the rigidity caused by muscular contraction; therefore in doubtful cases the examination should be made under an anæsthetic. The production of pain by attempted motion is good evidence that complete ankylosis is not present, because it is the movement of the parts that causes the pain. An approximate idea of the extent of the stiffness may be obtained from the clinical history of the case as to whether the disease has been violent in character and long in duration.

Treatment. — This is preventive and curative. The attempt to prevent the occurrence of ankylosis in joints that are the subject of disease by means of passive motion are usually not only futile, but positively harmful. Any violent or extensive movements only increase the inflammation and activity of the disease already present. The joint has enough to do to attend to the original disease without having to contend with the added violence of misapplied surgical energy. The amount of pain experienced is a good guide to the amount of motion to be practiced, if it is severe or long continued it is evidence that the movements have been too extensive. It is best to wait until the active evidences of disease have disappeared before attempting movements. In tuberculous and other diseases the attempt to restore motion is apt to relight the original trouble; therefore it is well to have as long an interval intervene as possible. Restoration of motion is only possible in cases of fibrous ankylosis, not bony, and when the disease has not been too extensive. The utmost that can be hoped for in many cases is the placing of the limb in a more useful position. When it is desired to restore motion in a stiff joint, the patient should be anæsthetized and the joint first flexed and then extended: this should be repeated until as much motion as possible has been secured. The part is then kept at rest and ice-bags applied until the resultant inflammation has subsided, then mild passive motion is to be employed for some time until it is seen whether anything has been gained. If not, then it is useless to repeat the procedure, for if no motion has been gained some will probably have been lost, and with each succeeding effort the condition of the joint is worse. Care must be taken not to fracture the bones in making the necessary manipulations. The bones from long-continued disease are apt to be somewhat atrophied and not so strong as they normally are. If it is desired to increase the extension of a joint, a good plan is to apply some sort of a splint or apparatus that holds the part in its most extended position and then remove it daily and apply passive motion and again

replacing the apparatus. An apparatus producing gradual pressure, such as the Strohmeyer screw, is often serviceable when it can be applied.

Case in which, as the result of forcible breaking up of ankylosis at the knee, there occurred gangrene, necessitating amputation through the thigh. Stavely (Med. Record. Oct. 20, '88).

Case of fatal fat-embolism after forcible straightening of both knee-joints. Ahrens (Beiträge zur klin. Chir., B. 14, H. 1, '95).

Stiffness arising from injuries such as fractures are usually due to their involving the joint and from misplacement of the fragments directly interfering with motion or else to pouring out of callus and non-bony effusion from the injured parts. Ankylosis from the former is to be prevented by a more correct apposition of the fragments before they have had time to become fixed in their abnormal position. Ankylosis from the latter is to be avoided by gentle and persistent passive motion.

In fibrous ankylosis, electrolysis: continuous current passed directly through the joint, with the negative pole nearest the adhesions, amount given ranging from 40 to 150 milliampères. F. W. Gwyer (N. Y. Med. Jour., June 8, 15, '95).

Bony ankylosis is to be treated either with a view of bettering the position of the part or to the formation of a false joint. If the former is aimed at, then osteotomy is of service, especially in cases of hip disease in which the neck of the femur is divided or a subtrochanteric osteotomy performed; also to remedy a bad position of the foot. In the knee the amount of deformity is usually so great as to require resection: here osteotomy is not applicable.

Case of excision of both knees for angular ankylosis. Newbolt (Lancet, Nov. 24, '95).

In the shoulder-joint ankylosis is not so disabling as in other joints, and usually no operation is advisable. If, however, motion is desired, it can be obtained by resection of the head of the bone. In the elbow-joint good results are obtained by a resection of the joint; good and serviceable motion is often obtained. When too little motion results, it is usually because too little bone has been removed. As healing progresses, what at first looks like a flail-joint becomes a very serviceable one. Ankylosis of the spine has been treated by forcible straightening of the kyphosis by non-operative means, but its true value as yet is undetermined. In some cases new bone has not formed to fill up the resultant gap, and consequently relapses are very liable to occur. Straightening in several sittings is better than to completely straighten at one. The articulation of the lower jaw becomes ankylosed at times, and is to be treated by liberal resection of bone, preferably done from within the mouth. The treatment of ankylosis of the finger-joints depends on the occupation of the individual. In people who have manual work to do, as machinists, carpenters, etc., a stiff finger is so much in the way and so often becomes injured that it is sometimes advisable to amputate it. The patient, however, should be the one to decide as to the advisability of amputation, and it is best to wait until by trial he finds the affected finger useless.

Gwilym G. Davis,
Philadelphia.

JUNIPER.—Juniper is the fruit or berries of the *Juniperus communis*, of the family *Coniferæ*, an evergreen of Northern Europe and America. The berries contain 2 to 2 $^1/_2$ per cent. of a volatile oil, upon which its medicinal

effects chiefly depend, a non-crystallizable principle (juniperin), and from 15 to 30 per cent. of sugar, etc. The volatile oil also exists in the leaves and other parts of the plant, and by first bruising and then macerating them in alcohol or spirit the liquor commonly known as gin is produced. The oil of juniper obtained from the wood is inferior to that distilled from the berries, which is the official form of oil from which the spirit and compound spirit are made. The compound spirit is the pharmacopœial substitute for gin and is to be preferred to the latter, which is frequently adulterated with oil of turpentine.

The oil of cade (oleum cadinum, U. S. P.), obtained by destructive distillation from the wood of *Juniperus oxycedrus*, is a thick, black, empyreumatic oil resembling and having the odor of tar, and having an acrid disagreeable taste. It is soluble in ether, chloroform, and carbon disulphide.

Literature of '96-'97-'98.

Juniper-tar (= oil of cade) contains (1) hydrocarbons (boiling-point, 210° to 400° C.), which form its greater part; (2) acetic acid and its homologues; (3) phenols and allied bodies; and (4) resinous substances, which form the residuum after distillation. (*a*) The chief difference between the phenols of coniferous trees (pine and juniper) and others (beech, birch, aspen, etc.) is that the latter contain diphenols and bodies derived from triphenols (pyrogallol), with small quantities of monophenols, while the former contain only diphenols, chiefly derivatives of pyrocatechin (guaiacol and its homologues, methyl- [= creosol] ethyl- and propyl- guaiacol). (*b*) Juniper-tar is poorer in phenols than that of pine or aspen. (*c*) It is less acid and has less disinfecting power than the other tars. (*d*) As a 5-per-cent. mixture with water its disinfecting action is almost *nil*. (*e*) An alkaline solution (5-per-cent. tar in 1-per-cent. KOH solution) has a marked disinfecting action, killing a two-day-old culture of intestinal bacteria from a body dead of cholera when mixed with it in equal parts in 20 to 30 minutes, a culture of typhoid bacilli in 2, and of B. pyocyaneus in 10 minutes. Still this action is inferior to that of an alkaline solution of pine-, birch-, or aspen- tar. (*f*) Anthrax-spores are killed by pure juniper-tar in 7 to 9 days, by its 5-per-cent. alkaline solution in 24 hours. (*g*) The alkaline solution has but a feeble action on pure cultures of tubercle bacilli, and does not kill them after 24 hours, for all guinea-pigs inoculated with these insufficiently-sterilized cultures died about the 60th day. (*h*) Juniper-tar is 9 times as expensive as pine, and 4 ½ times as birch. Witold de Schulz (Arch. des Sci. Biol. de l'Institut. Imper. de Méd. Expér. à St. Petersbourg, Tome v, Nos. 4, 5, '97).

Preparations and Doses.—Oleum juniperi, 1 to 15 minims.

Spiritus juniperi, ¼ to 1 drachm.

Spiritus juniperis compositus, 1 to 4 drachms.

Physiological Action.—The diuretic action of juniper is due to a stimulating effect upon the renal structures, which may reach irritation when the drug is administered in excessive doses. Anuria may thus be induced. These effects are produced by the volatile oil, which, first absorbed into the general system, is then eliminated through the kidneys. It also has a stimulating action upon the gastro-intestinal tract.

Poisoning by Juniper. — Juniper in overdose produces an irritant action on the gastro-intestinal canal and upon the genito-urinary tract. Its action upon the kidneys may cause strangury, priapism, hæmaturia, suppression, and uræmic intoxication. A violet-like odor may be detected in the urine. A rash like that following the use of copaiba is sometimes noticed.

Treatment of Poisoning. — If seen

early, the stomach should be washed out with a stomach-siphon, and diluent and dimulcent drinks used freely. An enema of laudanum or the use of morphine by hypodermic injection will relieve the poisonous effects, while stimulants will avert collapse.

Therapeutics.—Genito-Urinary Disorders.—As a stimulant to the genito-urinary tract juniper has long been considered valuable. It is especially indicated in chronic disorders, as chronic nephritis, chronic pyelitis, and chronic catarrhal inflammation of the bladder. Active acute inflammation contra-indicates its use. In the later stage of scarlatinal nephritis, when reaction has set in and the renal secretory apparatus is in an atonic condition, it is of great service. It is a very satisfactory remedy in various forms of dropsy. An infusion of the berries (1 ounce to the pint of boiling water) with the addition of $^1/_2$ ounce of cream of tartar may be taken daily, with benefit in chronic Bright's disease; it relieves markedly the œdema and effusions incident to that disorder.

> Juniper-berries tried in a case of renal dropsy with good results. Goldschmid (Corres. f. Schweizer Aerzte, Dec. 1, '88).
>
> As a diuretic for young children, 2 to 3 teaspoonfuls of the juice of the common juniper-berries are highly recommended. Vogel (Annual, '90).

Juniper gives relief in passive congestion of the kidneys and the lumbar pain, or sensation of weight across the lumbar region, so frequently experienced by aged persons, especially if the kidneys are inactive. Prostatorrhœa and gleet are generally benefited by juniper in moderate doses.

Gastro-Intestinal Disorders.—Juniper is a valuable stomachic. In small doses it increases the appetite and aids digestion. A few drops of the compound spirit in hot water will relieve the flatulence and pain of infantile colic. Gin is a favorite domestic remedy for pain associated with menstrual disorders. A few teaspoonfuls in hot water combined with external applications of heat generally gives prompt relief.

K

KERATITIS. — Gr., κέρας, cornea, and ιτις, inflammation.

Definition.—Inflammation of the cornea.

Varieties.—The varieties of keratitis are interstitial, neuropathic, malarial, dendritic, herpetic, punctate, phlyctenular, bullous, pannous, traumatic, striate, suppurative, and xerotic keratitis.

Symptoms.—The most constant symptom is opacity; and this may be the only objective symptom present. It may vary from the slightest increase of the haziness that is visible in the normal cornea, under strong oblique illumination, with a good magnifier, to complete opacity through which no trace of the iris or pupil is visible. The opacity always causes impairment of vision, proportioned to the extent to which it invades the part of the cornea in front of the pupil.

Redness is manifest, not usually in the cornea itself, but in the vessels at its border, which supply it with nutrient fluid; and the enlargement of which gives rise to the pericorneal zone. In chronic keratitis, however, as during the later stages of corneal ulcer, and in pannus, trunks of considerable size may be seen arising from the vessels at the corneal margin extending on the cornea,

and dividing, to be distributed to the superficial corneal layers. In interstitial keratitis great numbers of extremely-small vascular loops extend from the margin into the deep corneal tissue. As the inflammation goes on to resolution, the corneal vessels atrophy, and in most cases entirely disappear.

The pain of keratitis is usually severe. It may be that of a foreign body in the eye, a smarting, burning, or severe aching pain. It is commonly attended with photophobia, which may become intense, and with increased lacrymation. Swelling may occur in corneal inflammation, but it is inconstant and of little consequence.

Loss of substance, ulceration, is a far more important symptom. In many forms of inflammation the resulting ulcer is the most significant and most serious symptom. Its characteristics are closely identified with the variety of keratitis, and will therefore be considered under the special symptoms peculiar to each variety. In all corneal ulcers, however, extension usually occurs by the breaking down of an infiltrated area; and, while active, the surface of the ulcer, when wiped with a pledget of cotton, lacks the smooth reflex of the normal corneal surface. Before the ulcer begins to heal the points of infiltration disappear and the ulcer is said to be "clean." Its surface, too, becomes coated with epithelium, and, although not so even as the normal corneal surface, appears to have the same polish. As the loss of substance is made good with new-formed tissue, the lack of transparency in the scar-tissue gives rise to an opacity, which will be most noticeable some weeks after all signs of active inflammation have ceased. Such corneal opacity, and the possibility of perforation of the cornea, and its sequels (see CORNEA, volume ii) are the special dangers of ulcerative keratitis.

INTERSTITIAL KERATITIS begins with photophobia, slight redness, and irritability of the eye. Opacity appears faintly near the middle of the cornea, involving the deeper layers, and increases from day to day, and extends toward the periphery. Then at the border, usually the upper or lower border, the cornea becomes opaque, and fine loops of deep vessels push out in it, and extend gradually farther toward the centre, giving the tissue they invade a characteristic "salmon" color. Iritis or choroidal inflammation is liable to attend this form of keratitis, and may be manifest before the opacity of the cornea wholly hides the iris and pupil. Usually both eyes are affected. The course of this form of keratitis is essentially chronic, usually running through several months, and sometimes years before it subsides. The corneal surface often becomes quite uneven; but is rarely ulcerated. The disease generally affects both eyes; and usually occurs during childhood or youth, but may be met in early adult life, or even later. The patient frequently presents other evidences of inherited syphilis, particularly the Hutchinson teeth, or the nasal deformity; or the symptoms may be those that are grouped under the term scrofula.

> Three cases of late hereditary-syphilitic keratitis, appearing, respectively, at the ages of 20, 52, and 29 years. The cases were characteristic and gave additional proof of the fact that the absorption of the exudates in the cornea takes place all the more slowly and incompletely, the older the patients. In one instance the sclerosis was present five years after the beginning of the attack. A. Chevallereau (Jour. des Mal. Cut. et Syph., Sept., '95).

Literature of '96-'97-'98.

Instance of conjunctival interstitial keratitis of syphilitic origin. The case was seen directly after birth. The lids were swelled, and there was a dirty-yellow discharge from the conjunctiva. The corneæ were dull gray. Barabasher (Vestnik of Ophthal., May-June, '96).

A condition of keratitis interstitialis annularis in an eye with increased tension and intense congestion. Vision equaled ability to see to count fingers at four feet. There was a ring of deep and dense opacity between one and two millimetres in width, entirely surrounding the central two-thirds of the corneal area. The patient, a man 67 years of age, was suffering from hay fever. The acute symptoms quickly subsided under treatment, but the opacity persisted for about two months. Moulton (Annals of O., O., and L., July, '96).

Neuroparalytic keratitis, or neuroparalytic keratitis, is usually marked by diminished sensitiveness of the cornea to touch as compared with the sound eye. It also may be attended with iritis, but is commonly confined to one eye. The liability to it increases with age; and there is likely to be other evidence of involvement of the ophthalmic branch of the fifth nerve, as herpes zoster, neuralgia, or distinct paralysis. Curiously enough, it is possible to remove totally the Gasserian ganglion, and by careful protection of the eyes during the first few weeks, to escape any neuropathic keratitis. There is very likely to be ulceration, although this may not occur: and the ulcer may become infected and the keratitis loose its characteristic features. Its course is quite chronic: but healing, usually with more or less opacity, mostly occurs in three to six months.

Literature of '96-'97-'98.

Physiological experiments on monkeys demonstrate that the Gasserian ganglion has no trophic influence on the cornea, and also that the ophthalmic of the fifth nerve may be divided and the ganglion extirpated without risking the destruction of the eye. Turner (Abst. Rec. d'Ophtal., Mar., '96).

Malarial Keratitis.—Keratitis quite neuropathic in its clinical character may arise in malarial persons in connection with fifth-nerve lesions, especially malarial neuralgia. But in a more specific form, as in a linear branching ulcer, it also occurs with impaired sensibility to touch, and some opacity of the affected part of the cornea.

Case of malarial keratitis in which the inflammation was manifested as a peripheral annular parenchymatous infiltration separated from the corneal margin by a zone of clear tissue. The opacity consisted of numerous minute points joined by fine, grayish lines sometimes so closely packed together, however, that the intervening striæ could not be distinguished. Examination of the blood failed to show any malarial organism. Tenderness in the supra-orbital notch was marked. De Schweinitz (Phila. Polyclinic, July 6, '95).

Dendritic keratitis is a rare disease also characterized by linear branching ulcers, which tend to extend by the formation of new branches. These branches are usually straight lines meeting each other at definite angles. It may be acute, with severe pain, or chronic, with but a slight irritation.

Herpetic keratitis occurs late in the acute infectious fevers and in diseases of the air-passages. Small vesicles form on the cornea and rupture, giving rise to minute ulcers.

Punctate Keratitis.—The term *keratitis punctata* is usually applied to the small, rounded dots of opacity which form on the posterior surface of the cornea in iritis and cylitis. Isolated dots of denser opacity in the midst of a somewhat hazy cornea mark a chronic disease of probably syphilitic origin, not at-

tended with much redness or photophobia. Another form called *superficial punctate keratitis*, marked by dots and lines of opacity just below the anterior epithelium of the cornea, is attended with a good deal of conjunctival redness, pain, and lacrymation. It is liable to relapse, and may last for months.

Phlyctenular keratitis occurs commonly in young children, in close association with phlyctenular conjunctivitis. The phlyctenule containing cells and fluid arises on the surface of the cornea, and in a few hours, or a day or two, ruptures and gives rise to a small ulcer. Later a few branching vessels forming a long narrow leash, usually somewhat in a direction of a radius of the cornea, may make their way out from the nearest portion of the limbus to the region of the ulcer. This is especially likely to occur if several phlyctenules have successively arisen on the same part of the cornea. The condition is then spoken of as *superficial vascular* or *fascicular keratitis*. The ulcers rarely perforate the cornea, but may do so. This form is particularly liable to relapse. It is often attended by the most severe and obstinate photophobia.

Bullous keratitis is marked by recurrent attacks of severe burning pain followed quickly by the raising up of a large bleb or bulla on some part of the cornea. The epithelium forming the anterior wall of the bleb quickly ruptures, leaving loose shreds of epithelium and a broad abraded surface, which in a few days heals over, and some months may pass before there is a recurrence. Two forms of the disease are recognized: one occurring in eyeballs that have been the seat of severe inflammation of the uveal tract, and have undergone degenerative changes; and the other due to previous wounds of the cornea causing extensive loss of the corneal surface in an otherwise-healthy eye.

Literature of '96-'97-'98.

Primary bullous keratitis arises as follows: Some variable times after an abrasion of the cornea by the finger-nail, a twig, or such object, there occurs an attack of severe pain in the eye, which always begins in the morning when the patient wakes up. It usually lasts a few minutes, ceasing with the occurrence of an abundant flow of tears. These attacks recur with varying frequency. There is photophobia, hyperæmia, œdema of the lids, etc. At this stage there is discovered a large bulla of the cornea, which is frequently only half-filled with clear fluid and can be displaced on movement of the lower eyelid; a small spot of cornea is seen to be dull, and the bleb or its remains can be picked off with forceps, leaving a large, denuded surface with uneven margins extending to one-fifth or even as much as one-half of the area of the cornea. After three days or a little more, the denuded surface is again covered, but may break down soon thereafter, and the same process be repeated many times. There is usually several months' delay from the time of the original accident until the development of the bulla. Edmund Jensen (Arch. d'Ophtal., Apr., '98).

Pannous Keratitis.—Pannus is an inflammation and vascular opacity of the cornea, occurring in trachoma, after the palpebral conjunctiva has been severely affected. The portion of the cornea involved is that which comes habitually in contact with the lids; most frequently the upper part, but sometimes also the lower. The part affected is somewhat thickened with an irregular surface, and more or less hazy. It is usually bounded by a horizontal line marking the habitual position of the lid-margin. Large branching trunks of superficial vessels pass out upon the cornea, from the vessels of the limbus; their distribution is sharply limited by the line bounding the

affected area. Ulceration is not infrequent, but is not characteristic of this form of keratitis.

Traumatic Keratitis.—Injuries to the cornea may set up a general inflammation of the membrane; but more frequently they cause loss of substance of the cornea, and thus originate corneal ulcers. If small and not affected, such ulcers heal quickly, with little pain; and leave only a temporary opacity proportioned to their extent. If they involve an extensive surface, even though quite superficial, amounting to little more than an abrasion's removing the corneal epithelium, they may be extremely painful. If, as often occurs, they are infected, they present the features of a suppurating ulcer.

> Clinical and pathological study of four cases of ring infiltration of the cornea. In every instance the affection followed a perforating septic wound of the cornea, and the ring infiltration occupied precisely the same position, its outer edge being one millimetre distance from the corneal margin, irrespective of the position of the wound. Microscopically, the cell-accumulation between the laminæ of the cornea was found to be densest at a position almost equally distant from its anterior and posterior surface, or slightly nearer the anterior. Collections of cells were also sometimes found between Descemet's membrane and the corneal substance. E. Treacher Collins (Ophthalmic Review, Aug., '93).

> Injuries to the globe occur generally to the nasal or upper aspect of the bulbus, exceptionally to the temporal side; the cornea ruptures oftenest in youth, the sclera in old age. Müller ("Ueber Ruptur der Corneo-scleral Kapsul durch Stumpfe Verletzung").

Striate keratitis is seen after injury, especially after operations, like cataract extraction. In this case a number of fine-gray streaks, more or less perpendicular to the corneal incision, are noticed, from a few hours to a week or so after the operation. This form may also occur after an injury that has caused bending of the cornea. It usually ends in resolution.

> Filamentary keratitis is more frequent in the old than in the young. The primary growths seem to originate from a state of prolonged congestion of the cornea. These first appear as little spheres, which later become filamentous. There are a few signs of ciliary irritation: the cornea clears and becomes normal. In part, these filaments seem to have an epithelial origin, consisting of a gradual elongation of the surface-cells of the cornea. These are mingled with cells that are deposited from the conjunctival mucus. Nuel (Archives d'Ophtal., Oct., '92).

Suppurative keratitis always includes the formation of a corneal ulcer; and it is probably always due to some form of infection. The ulcer may be there first, and become infected, or the infection may occur in a previously-sound cornea, giving rise to an abscess; which in time breaks through, if not incised, forming the ulcer. In some cases the posterior layers of the cornea break down, forming an ulcer on the posterior surface.

Suppurative ulcer is marked by a margin which, at least at some points, is infiltrated, as the floor may be infiltrated. The tissue thus becoming involved in the ulcerative process is swelled, softened, yellowish in color, and swarming with bacteria. The germs most commonly present are the pus-cocci or the pneumococcus (diplococcus lanceolatus). This latter form gives rise to what is known as the serpent-ulcer: an ulcer that is liable to spread irregularly over a large part of the cornea without tending to rapidly perforate it. The margin of such an ulcer is generally of irregular outline, and abrupt or overhanging. The sup-

purating ulcer is often attended with hypopyon.

Xerotic keratitis begins with dryness of the conjunctiva; and a general haziness of the cornea, which soon leads to ulceration, perforation, and loss of the eye. Both eyes are generally affected; the disease occurs in feeble infants that rarely survive.

Diagnosis.—Keratitis is recognized by careful inspection of the cornea under the proper conditions of illumination. Slight opacity is rendered most evident by strong oblique illumination which should be so arranged that the light will be concentrated upon the cornea, while the iris behind it is left in comparative shadow, to furnish a dark background. Localized points of opacity in front of the pupil may also be studied with the ophthalmoscope, using the strongest convex lens behind the mirror, and looking from about the focal distance of the lens in front of the eye. Ulceration is best discovered by placing the patient where the light from a large window will be reflected from the surface of the cornea, such a reflex showing all the irregularities of the reflecting surface. To make sure that these irregularities are not filled in with mucus, that may render them invisible, it is well to wipe the surface with a pledget of cotton. Or to outline an ulcer more distinctly for treatment, it may be stained with a solution of fluorescin, 1 part; sodium bicarbonate, 2 parts; distilled water, 200 parts; or with one of toluidin-blue 1 to 1000.

Conjunctivitis.—Keratitis must be distinguished from conjunctivitis. Lesions of the cornea are the most common and the most dreaded complications of conjunctival inflammation. But more especially on that account is it necessary to recognize promptly when the cornea becomes involved. The treatment required by keratitis is, too, in many respects totally different from that appropriate to conjunctivitis. Unless the cornea itself exhibits the characteristic opacity or loss of substance, we cannot assume that it is affected. The redness of the pericorneal zone, while quite different from the typical redness of conjunctivitis, may be completely hidden by swelling of the conjunctiva.

Iritis.—The differential diagnosis between keratitis and iritis is also very important. Here, too, the detection of the actual lesions present in one or the other of these structures is to be relied on. Corneal disease may cause apparent discoloration of the iris; and in the early stage of keratitis the pupil is apt to be very small. But the use of a mydriatic (which would generally be very appropriate for either disease) will, in keratitis, produce regular dilatation of the pupil, even if it is not as wide as in the normal eye.

An error, much more grave, is to mistake *inflammatory glaucoma* for keratitis. Both diseases may present pericorneal redness, pain, photophobia, and haziness of the cornea; and glaucoma shows impairment of the sense of touch in the cornea, as markedly as does neuropathic keratitis. In the latter disease the tension of the eyeball may be diminished; in glaucoma simulating keratitis it is always increased. The pupil in glaucoma is more or less dilated; in keratitis, unless a mydriatic has been used, it is contracted or normal. The haziness of the cornea is more uniform and diffuse in glaucoma, while in keratitis it is more likely to be localized. Corneal ulcer may occur in glaucoma, but usually only in chronic cases. The chief pain of glaucoma is of an aching character, and is felt as much in the brow and cheek as in the eyeball. That of keratitis is more

likely to be smarting or burning, or the sense of a foreign body. If a mydriatic has been used and the pupil has been dilated, the tension of the eyeball and the ophthalmoscopic symptoms must be relied on. Haziness of the cornea, sufficient to prevent an ophthalmoscopical diagnosis, is not likely to occur in glaucoma, except when the increase of tension is so great as to be quite unmistakable.

Diagnosis of Various Forms of Keratitis.—The diagnosis of the particular form of keratitis present is often very important. Here the character of the opacity or ulceration may be of great significance. Interstitial keratitis will be known by the depth of the opacity, the fine loops of the vessels, the involvement of the iris, and the other evidences of constitutional taint. The history of a nerve-lesion or the loss of sensibility in the cornea point to neuropathic keratitis. In the malarial form there is obtainable a history of malaria, and the linear ulcers are in tissue having less than normal sensibility to touch. In dendritic keratitis these features are absent. Herpetic keratitis is characterized by the minuteness of the scattered ulcers and the history of previous illness; and punctate by the points of chief opacity. Bullous keratitis is known by the burning pain, followed by the large bleb or superficial abrasion. Pannus is readily recognized by the distribution of the vessels and the superficial opacity; and the evidence or history of preceding conjunctival disease. Traumatic and striate keratitis will give the history of injury. The suppurative ulcer will be recognized by the yellowish infiltration of the part of the cornea into which it is extending.

Etiology and Pathology.—The dominant facts in the pathology of corneal ulcer are that the cornea is a tissue closely related to the white, fibrous connective tissue of other parts, that it is non-vascular, that it is peculiarly predisposed to injury and infection, and that it is covered by epithelium liable to the same injurious influences as the epithelium of the conjunctiva. The tendency of the principle corneal tissue is shown in the controlling influence of the constitutional causes of interstitial keratitis and the prolonged stage of resolution in all forms of inflammation involving the true corneal substance.

The absence of blood-vessels is responsible for the frequent occurrence and disastrous extension of ulcerations, and the danger of the spread of whatever infection may occur. The extension of conjunctival infections of various kinds to the cornea is what might be expected from the similarity of their epithelial coverings.

> In pathological examination of 11 cases of purulent keratitis in the human subject, 5 of which were examples of ulcus corneæ serpens, 4 of keratomalacia, and 2 of beginning panophthalmitis, it was found that Descemet's membrane remained intact unless there was a complete perforation of the cornea, although at times the endothelial cells upon the posterior surface of this membrane were absent in many places. In these cases the corneal parenchyma was found to be œdematous, the corneal spaces being enlarged and filled with altered corneal cells and leucocytes with numerous nuclei. In several instances there was a distinct exudation of fibrin between the lamellæ of the cornea, especially, however, near the ulcer. The leucocytes invaded the membrane from the limbus and mainly in the superficial layers. In the cases of keratomalacia only the lower third of the cornea showed inflammatory change. In the ordinary forms of ulceration Bowman's membrane and the corneal epithelium were absent from about the ulcer. In the later stages of ulcus cornea serpens the epithelial cells were greatly increased, being absent only from near the

ulcers. The authors believe that hypopyon is formed from the iris and from the surrounding spaces of Fontana and Schlemm's canal. In the cases of panophthalmitis the inflammation had extended rapidly through the retina. Uhthoff and Axenfeld (Archiv f. Ophthal., B. 42, Ab. I).

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Trophoneurotic keratitis differs in its pathology from *keratitis e lagophthalmo* in that in the latter condition the lesion of the cornea is the result of exposure from an uncovered cornea, together with general loss of resistance on part of all the tissues. In trophoneurotic keratitis the lesion is found under the covered cornea. K. K. Wheelock (Ophthalmic Rec., Feb., '98).

Traumatism and infection play a part probably in all forms of ulcerative keratitis. Germs are always present in the conjunctiva and atmosphere. So that in the absence of resisting power on the part of the tissues every wound becomes infected. When, however, the germs are markedly pathogenic, as in the conjunctivitis which attends chronic lacrymal obstruction, or in that due to acute infection of the conjunctiva, the corneal lesion proves more serious. Swelling of the conjunctiva around the corneal margin, chemosis, prevents the lids from cleansing the cornea, and produces a sulcus, in which the infected discharges tend to accumulate. It is in this way that chemosis causes corneal involvement in gonorrhœal conjunctivitis. The peculiar forms of different ulcers and the way they extend are largely dependent on peculiarities in the growth of the organisms that cause them. Thus, the serpent ulcer, with its rapid extension laterally and its abrupt or overhanging margin, is probably due to the growth of the pneumococcus, which tends to spread between the layers of the cornea without penetrating them. Dendritic ulcer is probably also due to infection. Bullous keratitis may arise from obstruction in the lymph-channels in the part. Pannus is due to traumatisms by the roughened lids, probably with an added specific irritant. Xerotic keratitis may be infective, although the so-called xerosis bacillus is found abundantly in the normal conjunctiva.

Summary given of 130 cases of keratitis interstitialis diffusa, including 5 cases of keratitis interstitialis annularis. In the 5 cases of the annular form of the disease 4 were over 20 years of age. Its etiology remains unexplained. In 125 cases of the diffuse form hereditary syphilis could be positively determined in only 40 instances. Pfister (Cursalon Zeit. f. Balneol., Mar., '90).

Among 15,000 patients only 42 cases of interstitial keratitis were found; of this number 16 were males and 26 females. As a rule, the affection was bilateral, in only 9 cases occurring on one side. The average age of development was 13 ½ years, the earliest being 3 months and the latest 30 years. The complications of most frequent occurrence were affections of the tractus uvealis, and especially iritis; in all, characteristic teeth were found in 40 per cent. In more than half the cases hereditary syphilis could be proved (55 per cent.). Wernlly ("Keratitis Diffusa," '91).

Clinical, anatomical, and experimental facts point to interstitial keratitis even when it is clinically a primary manifestation, being either a symptom of an existing or a consequence of a previous morbid process in the uveal tract. What may be called clinically primary interstitial keratitis appears to have no uniform etiology. Hereditary syphilis is the most important and most frequent cause; local conditions may, however, influence the proportion in which this cause preponderates. Against the exclusive importance of syphilis may be mentioned:—

The absence of other indications of hereditary or acquired syphilis in 30 per cent. to 50 per cent. of the cases.

The occurrence of interstitial keratitis in animals.

The anatomical demonstration that the condition may sometimes depend upon a tubercular infection of the eye.

The fact that diseases of the uveal tract may be due to various causes.

Individuals who have never acquired syphilis may suffer in advanced life from interstitial keratitis.

Hutchinson's teeth do not appear to occur in the majority of cases; their presence points to the probable, though not the certain, existence of hereditary syphilis.

Recurrences of interstitial keratitis are not uncommon. E. v. Hippel (Graefe's Archiv, xlii. 2).

Dendritic keratitis considered an herpetic disease of the cornea due to constitutional causes, malarial poisoning being very prominent. Wilder (Med. News, July 15, '93).

Two cases of keratitis, 1 of them complicated with iritis, occurring in women of advancing age suffering from malignant uterine disease. The ocular trouble believed to have been caused by infectious emboli. Du Bois-Reymond (Zehender's klin. Monats. f. Augenh., Apr., '91).

Case of periodically-occurring attacks of keratitis, apparently depending upon menstrual disorder and chlorosis. Usually both eyes were affected, the attacks beginning after the appearance of the flow and lasting a few days longer. In the intervals the eyes were well and the vision good. Ransohoff (Zehender's klin. Monats. f. Augenh., Aug., '91).

Interesting case of parenchymatous clouding of the cornea following lightning-stroke in a girl 11 years old. There was present almost complete amblyopia and marked blepharospasm. After 18 days the cornea cleared spontaneously, and the patient regained full visual acuity. Denig (Münch. med. Woch., Aug. 20, '95).

As a result of bacterial study of fifty cases of suppurative keratitis, it is concluded that the pneumococcus is invariably the exciting agent in hypopyon keratitis. The lacrymal and nasal passages abound with this particular organism. Uhthoff and Axenfeld (Berliner klin. Woch., Nov. 25, '95).

Of 25 cases of hypopyon keratitis, the diplococcus was found in 23, either alone or associated with a staphylococcus. In 4 cases the micrococcus occurred in phlegmonous disease of the eye. Guaita (Recueil d'Ophtal., June, '94).

In the majority of instances of hypopyon keratitis the infectious agent is the diplococcus of Fränkel. In nearly all personal cases the germ was found in the mouth, giving rise to the suspicion of disease in that cavity. Bassa (Recueil d'Ophtal., June, '94).

In the exudate of scrofulous keratitis was found a coccus colored by Gram's method, liquefying in gelatin and producing keratitis in rabbits, which was believed to be staphylococcus pyogenes. Straub (La Sem. Méd., May 25, '92).

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Ocular lesions due to obstetrical interference are uncommon. Case of keratitis observed in the newborn which seems to have resulted from a prolonged application of the forceps. The left eye alone was affected, and its appearance suggested a purulent ophthalmia; but the eyelids were more markedly swelled than is the case in commencing ophthalmia, and there was scarcely any discharge. On separating the eyelids it was seen that practically the whole cornea was cloudy, and there was intense conjunctival hyperæmia. The treatment consisted in the application of ice, atropine, and boric lotions. Dujardin (Jour. des Sci. Méd. de Lille, Nov. 28, '96).

No specimen ever seen that would tend to show that pus-cells ever do or can pass through Descemet's membrane into the anterior chamber; their only way lies through the meshes of the ligamentum pectinatum. Alt (Amer. Jour. Ophth., May-June, '96).

The etiology of interstitial keratitis is not well defined, but hereditary syphilis is undoubtedly the usual origin. Von Hippel (Arch. f. Ophth., vol. xlii, pt. 2, '96).

From a clinical study of interstitial keratitis it is considered that in the majority of cases this affection of the deeper layers of the cornea is secondary to inflammation of the anterior part of the

uveal tract; also that it is due to congenital syphilis. Cook (Jour. Amer. Med. Assoc., Mar. 7, '96).

The most various infectious diseases, nutritional derangements, etc., may cause an interstitial keratitis. Among such causes by far the most frequent is hereditary syphilis; then comes tuberculosis, acquired syphilis, influenza, malaria, diabetes, etc. A. Greeff (Sammlung Zwangloser Abhand. aus dem Geb. der Augenh., '97).

Case of relapsing interstitial keratitis of uterine origin. A young woman aged 25 years, for a period of eighteen months, has had at each menstrual epoch visual troubles pertaining mostly to one eye, and marked by the appearance of white spots of infiltration in the cornea. The ocular trouble came on eight days before the appearance of the menses, and disappeared on their cessation. On one or two occasions almost the whole cornea was affected, and there was intense pericorneal injection and photophobia, persisting for a month. The patient was of a scrofulous disposition. Vaginal injections and attention to hygienic measures sufficed to disperse the ocular attacks, and the corneæ have regained their transparency. Kœnig (Soc. Franc. d'Ophtal., May, '97).

Horner's conception of the relation between eczematous eruptions of the skin and the anterior nares and the phlyctenular diseases of childhood is not always apparent, but nearly constant. The conditions that predispose to these local disturbances are essentially constitutional and no local treatment is in any large proportion of cases to be regarded with favor. On the other hand, constitutional measures are of the first importance and may alone be relied upon even in complicated cases, so far as the eye is concerned as a participating organ. D. S. Reynolds (Phila. Med. Jour., July 16, '98).

Prognosis. — Interstitial keratitis is always slow. In rare cases it may run its course in one or two months; quite as frequently it will require that many years. Until it has fairly begun to subside no one can tell how severe or how protracted the attack will be. If seen early it is pretty safe to predict that the eyes will get worse in spite of all treatment before they will begin to get better. If seen at the height of the attack great improvement may be promised, continuing over a long period. Useful vision will probably be restored even when everything but light-perception has been lost. But complete recovery with normal vision rarely, if ever, occurs. If the opacity is most marked at the centre of the cornea and many fine vascular loops are seen which extend but a little way on the cornea, the disease is still in an early stage. If the vessels are rather sparsely diffused throughout the cornea, and the opacity chiefly confined to the central region, it is probable that the periphery of the cornea has already cleared, and that the most rapid improvement of vision is about to take place.

For the rarer forms of neuropathic and malarial keratitis the prognosis must depend considerably upon the general condition of the patient. There is some danger of relapses; and it must not be forgotten that ulcers from this disease are liable to infection, with all the consequences thereof. At the best they are likely to leave the affected portion of the cornea nebulous and irregularly astigmatic. Herpetic ulcers, unless greatly neglected, commonly leave no trace. Punctate keratitis usually leaves the cornea slightly damaged; and the syphilitic form is very chronic, with quite incomplete resolution.

Phlyctenular keratitis, if carefully treated, commonly leaves very little permanent damage of the cornea. But, occurring in the children of the ignorant and careless, it is very often neglected; so that a large proportion of the nebulous corneas with high, irregular astigmatism

are due to it. It is extremely liable to relapse; but the single attack yields promptly to treatment, or terminates often within two or three weeks in spontaneous recovery. The tendency to recur is the serious feature of bullous keratitis. But permanent complete recovery may occur in the cases due to traumatism.

Pannus rarely ends in complete recovery. It depends largely on the condition of the lids. If these can be rendered smooth and do not press upon and rub the cornea, it will get comparatively clear, and free from vessels. But some irregular astigmatism always remains. Fortunately the disease does not usually involve the part of the cornea in front of the pupil; so that normal vision may be retained. Striate keratitis usually clears up entirely in a few days or a few weeks. In other forms of traumatic keratitis the prognosis depends on the situation and extent of the loss of substance.

In suppurative keratitis there is always more or less permanent opacity; which is of serious or slight importance according to its situation. The density of the opacity is somewhat proportioned to the depth of the ulcer causing it. The danger of extension in an infected ulcer is indicated by infiltration of its margins or base; that is, by the extent to which the process is invading new tissue. When this extension ceases, when the ulcer becomes "clean," improvement is to be expected. Ulceration is particularly dangerous to the cornea, because it is nonvascular; and when, in the course of an ulcerative keratitis, vessels extend out from the limbus, and invade the floor of the ulcer or the tissue immediately around it, the danger of perforation passes away. Perforation, with prolapse of the iris into the opening, always causes a permanent leucoma, which is serious according to its size and location (see Cornea, Opacities of, volume ii). Suppurative disease of the cornea is often the starting-point of an infection that ends in panophthalmitis, or a slower inflammation of the uveal tract, and chronic degenerative changes. And perforating ulcer may ultimately cause sympathetic disease of the other eye.

Treatment. — While the removal or treatment of the special causes varies with the different forms of keratitis, certain general principles are applicable to the treatment of all kinds of corneal inflammation. In the first place, the general health of the subject has much to do with the resisting power of the cornea, and should be guarded and built up in every way. This does not mean that stimulants should be used in the majority of cases. But it does mean that the patient should have sufficient nourishing food, fresh air, enough exercise to keep the circulation and respiration active, sunlight and the influences of cheerful surroundings, and plenty of sleep. To secure sleep it may be necessary to give analgesics; but these should be given in small doses, and only to supplement the influence of fresh air and exercise. It may be well to give a laxative, when needed to promote digestion; but active purgation should be avoided. Tonics may be indicated, and full doses of tincture of the chloride of iron seem to have a distinct influence in checking suppuration.

> Use of salt-baths and the internal administration of sulphide of calcium strongly recommended in the treatment of strumous children suffering with phlyctenular keratitis. Keyser (Amer. Ther., Apr., '93).

> In rheumatic sclerokeratitis the most useful remedy is sodium salicylate, 60

grains daily. Evans (Pfalz Centralb. f. Augenh., Jan., '95).

Local measures must be such as to support, not impair, the vitality of the part. On this account cold applications must be avoided, even where they would be indicated if it were not for the corneal lesion. On the other hand, anything that will keep the eye continuously warm and moist, acting like a poultice, is liable to be injurious. Applications of hot fomentations for a few minutes at a time, or the more continuous application of dry heat, may be beneficial. The danger of its poulticing effect should generally exclude the bandage; but under certain circumstances it may be best to use it. These are: in neuropathic keratitis when the slight traumatisms to which the cornea is exposed when the eye is open decidedly aggravate the trouble, and when there has been an injury causing a clean loss of the corneal substance,—an uninfected ulcer. The eye should be kept closed, in any case of corneal ulcer, when exposed to dust that would be likely to lodge in the cavity or be pushed into it by the normal movements of the lids.

In trophoneurotic keratitis treatment must look to restoration of the function of the nerve, which is best accomplished by the stimulating influence of the constant current, supplemented by strychnia. Locally, bandages and hot-water compresses are employed. Wheelock (Med. Rec., July 26, '90).

Simple method for the treatment of grave ulcers of the cornea complicated with hypopyon. After washing the conjunctival sac with a 1-to-5000 sublimate solution, the closed lids are covered with a thick compress of salolized gauze, antiseptic cotton, and, finally, a damp tarlatan bandage, which, in drying, forms an immobile dressing and secures equal compression. This dressing is renewed every three or four days, till cure is effected. Very satisfactory results claimed. The same success is achieved in simple ulcers without hypopyon, in scrofulous ulcers of children, and in all ulcerative keratites. Valude (La Sem. Méd., Feb. 11, '91).

In the treatment of keratitis neuroparalytica the chief indication is protection to the eye by occlusive dry dressing, and the application of vaselin and iodoform, while, in general, treatment should be directed to the underlying cause. Panas (Recueil d'Ophtal., Nov., '92).

In the treatment of corneal inflammations and opacities hot boric-acid compresses and calomel insufflations found most efficacious. Chauvel (Rec. d'Oph., Oct., '92).

Chloride of sodium in the strength of 4 to 1000 and the application of a bandage are the best means of combating keratomalacia. Berger (Revue Gén. d'Ophtal., May, '94).

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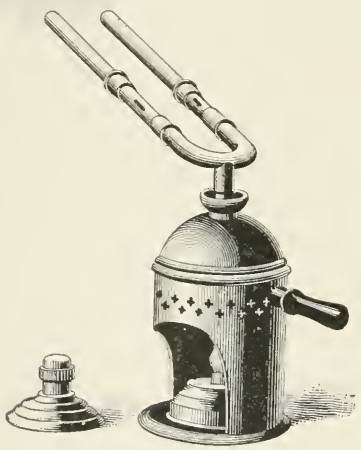
Local treatment of interstitial keratitis consists in keeping the pupil dilated with atropine, and the use of warm compresses or frequent warm bathing of the eyes during the active inflammatory stages, with moderate, not excessive, protection of the eyes from light: and, for the residual opacities after the acute stage has subsided, massage with a mercurial or iodide-of-potash ointment (10 to 20 per cent. of the yellow oxide of mercury, or 10 per cent. of iodide of potash), the massage being done by rubbing the cornea strongly with the finger through the closed lids twice a day for five to ten minutes, a drop of cocaine solution being previously instilled if the patient is sensitive. In the constitutional treatment no means are to be neglected which may improve the condition of the patient's general health, and, secondly, where syphilis is present, the special indications are threefold, viz.: mercury, sweating, and iodide of potash. Decided preference given to the inunction method. As a sequel to the mercurial treatment it is distinctly advantageous to give the patient a course of iodide of potash: 30 grains of the salt are given per day, until he has taken 25 to 40 drachms. R. Greeff (Sammlung Zwangloser Abhand. aus dem Geb. der Augenh., '97).

Apparatus for applying steam in eye-work. It is arranged so that either one or both eyes can be steamed at the same time. The chief essential is that it be so constructed as to prevent the patient's being burned by the steam. This is here accomplished by a diaphragm with only one-half millimetre perforation placed about halfway in each projecting arm. Just beyond this small perforation there is a larger external one, which permits the air to mix with the steam before it escapes from the end of the tube. The treatment is begun by placing the eyes



Steam-generator for inflammation, ulceration, and opacity of the cornea. (*Bissell.*)

of the patient about six inches from the opening and gradually having him approach to within three inches; by so doing the temperature of the steam when it reaches the eyes increases from 100° F. to 112° F. The steaming is continued from ten to twenty minutes. In this way it has been used in a large number of cases of inflammation, ulceration, and opacity of the cornea, with very gratifying results. After the steaming process, yellow-oxide-of-mercury cerate, calomel powder, resorcin, or whatever agent seems indicated, is placed on the cornea, and gentle massage made over the closed lids.

Elmer J. Bissell (Jour. of Ophthal., Otol., and Laryng., Oct., '98).

In all corneal inflammations cleanliness or asepsis is of the highest importance. This is to be secured by douchings of the conjunctival sac, and the wiping away of discharges when this is necessary. If there is no conjunctival discharge washing out the eye once or twice a day may be sufficient. If there is profuse discharge, cleansing the eye every hour may be necessary. The solutions employed should never be irritant, the 2-per-cent. boric-acid solution, or the normal salt solution (3 grains to the fluid-ounce) are the best. They should be applied at blood-heat or a little warmer. To wipe away any masses of discharge that accumulate, swabs of absorbent cotton moistened with the cleansing fluid, to prevent the cotton from sticking to the eye, may be used.

In keratitis suleata myeotica the best therapeutics consists in mildly-antiseptic and soothing applications. If these prove inefficient, in addition to antiseptic washes with 1-per-cent. biehloride solution, eserine-vaselin (20-per-cent. strength) should be smeared into the conjunctival sac, as recommended by Emmert. Makrocki (Zehender's klin. Monats. f. Augenh., Mar., '90).

Literature of '96-'97-'98.

The most effective treatment of corneal ulcers is antiseptic washes, subconjunctival injections, and the galvanocautery. Abadie (Rec. d'Ophtal., Mar., '96).

A 4-per-cent. solution of common salt, used subconjunctively, found quite as effective as the different solutions of corrosive sublimate in the treatment of corneal ulcers. Wood White (Birmingham Med. Rev., Jan., '96).

Formalin found to give excellent results in the treatment of infecting ulcers of the cornea and in purulent conjunctivitis. The strength to be employed as a collyrium is from 1 to 1000 to 1 to 2000. Burnett (Ophthal. Rec., Mar., '96).

The pain of keratitis is commonly lessened by instillations of atropine or other mydriatics. It may also be mitigated by brief applications of very hot water to the eye, or the internal use of acetanilid, morphia, or codeia in small doses. It is temporarily relieved by cocaine. But this should never be prescribed, because the after-effects are altogether bad; and the temporary relief it affords tempts the patient to frequently repeat the applications, each of which aggravates the disease. The new local anæsthetic, holocaine, is less likely to be harmful when used in this way, and it has a decidedly antiseptic action; but whether it is entirely safe is yet to be determined. The best cure for pain is, in general, the cure of the condition causing it. It is in this way that physostigmine (eserine) quickly relieves the chronic very painful shallow ulcers that occur at the margin of the cornea in elderly people, with chronic catarrhal conjunctivitis. Photophobia may be lessened by the wearing of dark glasses and the avoidance of sudden changes to a bright light. But it grows rapidly worse if the patient be confined to a dark room; and the confinement is likely to react unfavorably on his general physical condition. Of course, during an active keratitis the eyes should, as far as possible, be allowed to rest.

Excellent results from the use of a warm solution of chlorate of potash, 5 grains to 1 ounce, in phlyctenular ulcerations of the cornea. Bane (Western Med. Reporter, May, '91).

For the cure of hypopyon keratitis the instillation of a solution of sulphate of eserine, 2 grains to 1 ounce, and the constant application of a bandage, together with general tonic treatment highly recommended. Manche (Brit. Med. Jour., Jan. 17, '91).

In a case of recurrent keratitis superficialis punctata the use of cocaine caused an increase in the severity and duration of the attack. Bronner (Brit. Med. Jour., June 18, '92).

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Importance of directing treatment to the conjunctiva in cases of keratitis emphasized, even where the corneal condition seems to be predominating. Two instances of severe corneal lesion were cured only when a slight follicular conjunctivitis, which was present, was actively treated. Trousseau (Archives d'Ophtal., Mar., '96).

Special Treatment. — Interstitial keratitis especially requires the employment of mydriatics on account of the tendency to involvement of the iris. Atropine may be used in solution of: atropine sulphate, 1; distilled water, 60. The frequency and freedom of its applications may be limited by the tendency to cause mydriatic intoxication. When sufficient to keep the pupil well dilated, the strength of the solution and the frequency of its application may be diminished. Locally, hot fomentations, and sometimes local bleeding from the temple, may also be employed. But the curative treatment is probably chiefly constitutional: first, the preservation of the general health; and, after that, the prolonged administration of mercury and the iodides in moderate doses. Codliver-oil, iron, and arsenic are sometimes most beneficial.

Little can be done locally in interstitial keratitis. No treatment can prevent the second eye's becoming affected. Where syphilis can be demonstrated, an antisyphilitic treatment is indicated whether the keratitis is influenced thereby or not. Subconjunctival injections have no special local influence. In certain cases in which there is no indication of syphilis, salicylate of soda appears to do good. The experience, so far, of paracentesis of the anterior chamber is insufficient to prove that it has any therapeutic value. Iridectomy is of no value except where

there are the well-recognized indications for its performance. In certain cases where the process is confined to a small peripheral portion of the cornea it may sometimes be checked by the excision of the adjacent subconjunctival tissue. E. von Hippel (Graefe's Archiv, xlii, 2).

For neuropathic, malarial, and herpetic keratitis, the general and tonic treatment is of most importance, with careful protection of the eyes from irritants.

Phenate of mercury recommended in diseases of the cornea, especially in herpetic phlyctenular keratitis. Galezowski (Ann. d'Ocul., Jan., '95).

The treatment recommended to prevent keratitis after destruction or removal of the Gasserian ganglion is: Stitching the lids together for the first few days, and, after the removal of the dressings keeping the eye covered with a Buller shield for a month. For punctate keratitis atropine should be applied. Bullous keratitis may be met with atropine and hot applications during the attack; and regular massage with some mild ointment during the intervals. It may also become an indication for the enucleation of a degenerated eye.

Two cases of keratitis bullosa. The first was seen in an otherwise-healthy eye. A cure was seemingly effected by opening the sac, thoroughly removing the pellicle, and applying a 4-per-cent. solution of nitrate of silver. The second case occurred in a glaucomatous, sightless eye. Here, all treatment failing to permanently relieve the condition, the eyeball was enucleated. Colburn (Jour. Amer. Med. Assoc., Mar. 5, '92).

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The great point in treatment of bullous keratitis is prevention. When an eye has been injured by such an accident as a nail-scratch it should be carefully bandaged until healing is complete. When once the bleb has formed, the shed epithelium should be picked away, atropine instilled, and a bandage applied. Cocaine should not be used in such cases. Edmund Jensen (Arch. d'Ophtal., Apr., '98).

Dendritic ulcer should be scraped and touched with a solution of silver nitrate or formaldehyde of a strength of 1 to 60. Phlyctenular keratitis was long known as the common form of scrofulous ophthalmia, and must be treated with especial reference to the general conditions that accompany it. Out-door life; plain, readily digested food; and the avoidance of sweets, tea, and coffee must be insisted on. Codliver-oil and syrup of iodide of iron are standard remedies. The child must not be allowed to keep the eye buried in the pillow or handkerchief; but should be encouraged to overcome photophobia by exposure to the light and air. Local treatment is also very important. Photophobia will be diminished by the instillation of atropine. The ointment of: yellow oxide of mercury, 1 part; petrolatum, 60; should be used in the conjunctival sac every night. The lower lid being drawn down, a piece of the ointment the size of a grain of rice is placed on its inner surface, and the lids are closed and then rubbed gently over the eyeball for a minute or two. If there is much redness of the ocular conjunctiva or enlargement of the veins on the inner surface of the lids, tannin, 1; glycerin, 60; should be applied to the everted lids every day or two. Treatment should be continued many weeks after an attack to prevent recurrences. A most important measure for the same purpose is the thorough eradication of all morbid conditions discoverable in the nose.

Case of instantaneous blindness observed in a child, 11 years old, also affected with strumous keratitis. The ophthalmoscope revealed a large extravasation into the choroid in the macular

region. Under the continued administration of calomel, vision gradually improved. Dujardin (Jour. des Sci. Méd. de Lille, Oct. 13, '93).

In the treatment of phlyctenular keratitis complicated by pannus, kerotomy will work a cure more rapidly and more certainly, and absorption of the exudate is more complete, than in other methods. Verry (Revue Méd. de la Suisse Rom., Nov., '91).

Pannus requires the thorough treatment of the morbid conditions of the lids which cause it, sometimes including canthoplasty, or other operations on the lids to relieve the cornea from abnormal pressure. Other special measures for the treatment of opacity are mentioned in volume ii.

In oyster-shucker's keratitis the yellow salve has proved useless. A compress bandage and a mild sublimate solution (1 to 4000) used every four hours, together with an occasional drop of a solution of atropia—1 per cent.—have given the best results. To this treatment the keratitis responds promptly, and in a week or ten days the subjective phenomena have been so ameliorated that the shucker can resume work. The opacity can be detected by oblique illumination, and is permanent. R. L. Randolph (Johns Hopkins Hosp. Bull., Nov., Dec., '95).

Suppurative keratitis requires the prompt and thorough removal of infective discharges and infected tissue so far as possible. Corneal abscess should be freely opened as soon as it is recognized. For infected ulcers the simplest and most generally applicable treatment is scraping or curetting. The tissue around the ulcer should be thoroughly and repeatedly scraped toward the ulcer so as to empty the interlamellar spaces of their contents; and all softened tissue should be removed. After scraping, the ulcer should be closely watched; and upon any evidence of farther extension of the infective process thoroughly scraped again.

In cases of ulceration of the cornea occurring in "lymphatics" where the process of repair is sluggish, notwithstanding that a leash of blood-vessels supplies the ulcer, the performance of peritomy advised. Dunn (N. Y. Med. Jour., June 17, '93).

Equally as efficient as scraping, though a little more alarming to the patient, is the application of the actual cautery. This application may be made with the galvanocautery tip; or with a piece of steel knitting-needle, one end of which is held in an alcohol-flame until white hot, and then quickly applied to the affected portions of the cornea. The cauterization should include all infected parts of the tissue. After cauterization the eye may remain undisturbed for a day or more except that it must be kept cleansed.

Two cases of traumatic keratitis successfully treated, after they had resisted other measures, by cauterizing the ulcer with pure carbolic acid. A. D. Williams (St. Louis Med. and Surg. Jour., Jan., '90).

Deliquescent carbolic acid highly recommended as a cauterizing application to corneal ulcers. A single cauterization in the commencing stage will at once convert the ulcer into a healing wound. Suarez de Mendoza (Annales d'Oeul., May, June, '91).

In the treatment of infectious ulcers of the cornea, excellent results obtained from touching the ulcer once or twice daily with tincture of iodine. The advantages claimed are the prevention of staphyloma and the formation of corneal cicatrices less opaque than those resulting from other methods of treatment. Chibret (Recueil d'Ophtal., Sept., '91).

Scraping and cauterizing the diseased tissue instantly relieves the pain and photophobia in ulcerative keratitis. The new tissue is more transparent than that which follows any other mode of treatment. De Wecker (Ann. d'Oeul., July, '93).

The actual cautery considered applicable especially to sloughing ulcers, to ulcers in which the spread of local infection is the dominant symptom, to ulcers which decline to heal under moderate means. De Schweinitz (Amer. Jour. of Ophthal., Apr., '91).

A powerful agency for draining the affected tissue, and establishing lymph-currents that shall check the progress of infection, is the Saemisch incision, made by thrusting a narrow cataract-knife beneath the ulcer and letting it cut directly out dividing all the affected tissues and permitting the free drainage of fluid from the anterior chamber.

In cases of hypopyon from traumatic ulcer the instillation of a drop of a weak solution of sulphate of quinine and atropine, every two or three hours, rarely fails to cause absorption, if the case be seen before the pus has become thick and glutinous. R. Williams (Liverpool Medico-Chir. Jour., July, '91).

In case of extensive ulceration of the cornea and conjunctiva, adhesion prevented by the employment of an eye-shell made of vulcanized rubber. Searles (Amer. Jour. of Ophthal., June, '93).

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In ulcus cornea serpens any procedure that induces long-continued abolition of the anterior chamber may induce glaucoma, and is, therefore, to be rejected. Sachsalber (Beit. z. Augenh., Feb., '96).

Thioform found better than iodoform, boric acid, and all other dry applications in ulcer of the cornea. Rogman (Ann. d'Oeul., Mar., '96).

Methyl-violet and subjunctival injections recommended in corneal ulcers. Darier (Rec. d'Ophtal., Mar., '96).

In keratitis personal treatment is to apply to the floor of the corneal ulcer silver nitrate in 30-grain solution. Woods (Presb. Hosp. Rep., Jan., 93).

Excellent results obtained in the treatment of hypopyon keratitis by subconjunctival injections of corrosive sublimate (1 to 1000). Nikolikin (Vestnik of Ophthal., July-Oct., '96).

Subconjunctival injections of mercury used in infectious keratitis associated with hypopyon in eighteen cases. The writer prefers a solution of the cyanide, 1 to 100, and injects as much as 5 centigrammes. Fromaget (Ann. d'Oeul., Apr., '96).

The treatment of filamentous keratitis consists in abrasion of the filament, at the surface of the cornea, and the employment of a collyrium of methyl-violet 1 to 10,000. Sourdille (Le Prog. Méd., Apr. 4, '96).

Hypodermic injections of iodine successfully employed in cases of parenchymatous keratitis. Lodato (Vestnik of Ophthal., May, June, '97).

The acrid expressed juice of the bitter cassava is a useful remedy in the treatment of corneal ulcers. S. D. Risley (Archives of Ophth., July, '98).

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KIDNEYS, DISEASES OF. See RENAL DISEASES and RENAL SURGERY.

KIDNEYS, INJURIES OF. See ABDOMINAL INJURIES.

KINO.—Kino is the inspissated juice of *Pterocarpus marsupium*, a leguminous tree of the East Indies and Malabar. It is obtained from incisions into the trunk, and is dried without artificial heat. It occurs in fragments of a ruby-red color, without odor, and of a sweetish, astringent taste. It is soluble in alcohol, ether, boiling water, and alkalies, but only slightly soluble in cold water. Its most important constituent is kinotannic acid. It also contains kinoin, a crystalline neutral substance; pyrocatechin, pectin, etc. Kino is an ingredient of the pulvis kino compositus (B. P.) and also of the pulvis catechu compositus (B. P.).

Preparations and Doses.—Kino, 5 to 30 grains.

Tinctura kino, $^1/_2$ to 2 fluidrachms.

Physiological Action. — The physiological action of kino may be said to be that of its main constituents, kinotannic and gallic acids, especially the former. It is an astringent and styptic, preserving its activity in these particulars throughout the entire length of the intestinal tract. Its value in arresting intestinal hæmorrhage is thus accounted for.

Therapeutics.—Kino is a mild astringent. It is useful in serous diarrhœa, for which purpose it is generally combined with paregoric and chalk mixture, or exhibited in the form of compound powder of kino (B. P.), which consists of kino, 15 grains; powdered cinnamon, 4 grains; opium, 1 grain. Five to 20 grains are given as a dose. Kino is a serviceable remedy in pyrosis.

Locally and internally kino possesses some value as an hæmostatic in passive hæmorrhage from the intestines and other viscera. The tincture may be used as an astringent gargle in pharyngitis or for relaxation of the uvula. It is often an ingredient of injections in gonorrhœa and leucorrhœa. The powder may be applied as stimulating astringent dressing to chronic ulcers. In relaxed conditions of the mouth and throat and in epistaxis the tincture may be used with benefit.

KRAMERIA.—Krameria, or rhatany, is the root of *Krameria triandra* and of *Krameria ixina* (polygalæ), small shrubs growing in South America, especially in Peru and Bolivia. The bark of the root is strongly astringent in taste and almost without odor. The woody part is devoid of taste and odor and is relatively inactive. The smaller roots are therefore preferred. Krameria contains about 20 per cent. of krameria-tannic acid (the active ingredient), gum, starch, sugar, lignin, and a peculiar acid called krameric acid. An alkaloid, rathanine, has also been isolated. Krameria is an ingredient of pulvis catechu compositus (B. P.).

Preparations and Doses.—Krameria, 5 to 30 grains.

Extractum krameriæ, 5 to 20 grains.

Extractum krameriæ fluidum, $^1/_4$ to 1 fluidrachm.

Syrupus krameriæ, 2 to 6 fluidrachms.

Tinctura krameriæ, $^1/_2$ to 2 fluidrachms.

Trochesci krameria, 1 to 2 troches.

Physiological Action.—The krameria-tannic acid gives to krameria physiological properties very similar to those of tannic acid. It seems, however, to concentrate its effects upon the mucous membranes; hence its beneficial influence in all conditions characterized by relaxation of the latter: leucorrhœa, catarrhal disorders of the nose, pharynx, intestines, etc.

Therapeutics.—The value of krameria depends upon the tannic acid which it contains. It is used largely as a remedy for bowel disorders, in chronic or serous diarrhœa, in dysentery, and in passive hæmorrhage from the intestines and other viscera. In leucorrhœa and gonorrhœa its astringent action is valuable. Chronic pharyngitis and conditions of the respiratory mucosæ are generally benefited, but tannic acid is more convenient and effective.

KUSSO. See Parasites, Intestinal.

KYPHOSIS. See Spinal Curvature.

L

LABIA, DISEASES OF. See VULVA.

LABOR, ABNORMAL. See PARTURITION.

LACRYMAL APPARATUS, DISEASES OF THE.

Secretory Apparatus, Diseases of the.

DACRYOADENITIS. — Inflammation of the lacrymal gland is of rare occurrence, either in the acute or chronic form. It is indicated by swelling and œdema of the upper lid, and pain and tenderness on pressure of the gland and the adjacent supra-orbital margin. The disease may assume a purulent form, when an abscess may open, either upon the conjunctiva or through the skin.

Acute dacryoadenitis of the inferior accessory lobules, in a man 25 years of age. The disease presented itself as a small tumor under the bulbar conjunctiva, one centimetre up and out from the corneal limbus. Antonelli (Recueil d'Ophtal., Aug., '94).

Rheumatism, cold, syphilis, septicæmia, and mumps have all been ascribed as the cause in various cases, while the spread of inflammation from the conjunctiva and cornea has been noted in a number of instances.

Treatment. — Hot applications and poultices in the early stages, followed by free incision under the supra-orbital region as soon as pus has formed. In the chronic variety the local application of absorptive ointments, such as the mercurial and compound iodine, should be employed, while iodide of potassium, mercury, and the salicylates should be administered internally. In acute cases an active calomel purge should be prescribed, followed by large doses of quinine.

In acute inflammation of the gland, satisfactory results from the use of quinine, leeches, and mercurial inunctions to the brow. Chronic inflammation best treated by pressure, and the local application of iodine. Galezowski (Recueil d'Ophtalmologie, Oct., '92).

Case of symmetrical dacryoadenitis in which internal administration of iodide of potassium was followed by rapid subsidence of the swelling. Snell (Lancet, July 23, '92).

Case of non-suppurative inflammation of the lacrymal glands occurring in a negress, with a history of rheumatism. Mercuric chloride and potassium iodide, with applications of hot water to the tumors, caused cure. R. L. Randolph (Archives of Ophthal., vol. xxvi, No. 1).

TUMORS.—Neoplasms, such as sarcoma and adenoma, and hypertrophy of the gland, are of rare occurrence. The latter is at times of congenital origin, but is usually an affection of later years. The gland may attain a large size, and cause serious damage to the eyeball by compression.

ATROPHY of the lacrymal gland is very rare, being usually associated with xeroma of the conjunctiva.

DACRYOPS is the name given to a cystic disturbance of one of the ducts of the gland, and occurs as a bluish-pink, translucent, elastic tissue, which is found under the conjunctiva in the position of the gland.

LACRYMAL FISTULA may form occasionally as a sequel of inflammation or traumatism of the gland, and may cause a constant discharge of tears through its orifice. A similar condition has also been observed of congenital origin.

DISLOCATION OF THE GLAND has been met with in a few instances as a result of trauma, and in a very few in which the prolapse was congenital. In other rare instances it was spontaneous in origin.

Case of infant who fell and ruptured the external orbital soft tissues, dislocating the lacrymal gland. The hernia was reduced and the skin sutured. The function of the organ was not disturbed. Bistis (Ann. d'Oculist., Dec., '95).

Case of traumatic prolapse of lacrymal gland in 2 1/2-year-old-boy due to fall on sharp stones; excision; no perceptible difference in moistening of eyes or flow of tears, confirming de Wecker's theory concerning emotional lacrymation. Haltenhoff (Ann. d'Ocul., May, '95).

Treatment.—Extirpation of the gland is indicated in cases of neoplasms and extreme hypertrophy, or where there is obstinate stillicidium which cannot be controlled in any other way. This is accomplished by removing the gland, either directly through a skin incision made over the gland, or by an incision through the conjunctiva after exposure of the *cul-de-sac*, by division of the external canthus. The latter procedure is the one usually employed, as the ptosis which is apt to follow the first mentioned, due to injury of the levator, is avoided, and the resultant scar is much less conspicuous.

Three cases of tumor of the lacrymal gland. The only operative procedure indicated in the second stage of the disease is the horseshoe-incision, made sufficiently far from the orbital rim to avoid injury of the frontal nerves. Dianoux (Ann. d'Ocul., Aug., '94).

In case of hernia of the lacrymal gland, produced by traumatism, protruding portion removed without interfering with the function of the gland. Panter (Omaha Clinic, June, '92).

In treatment of catarrhal lacrymal obstructions with epiphora, ablation of the palpebral portion of the lacrymal gland advised if symptoms persist after the ordinary treatment has secured a permeability of the lacrymal passages. Terson (Recueil d'Ophtal., May, '91).

The removal of the lacrymal gland is a procedure demanding consideration in the treatment of simple or complicated epiphora, and of those instances which resist ordinary means. It is an operation which should be held in reserve and as a last resource. Palpebral removal is an operation of choice, suitable for simple and for the majority of complicated cases; whereas orbital removal is an operation of necessity. True (Archives d'Ophtal., May, '93).

Excretory Apparatus, Diseases of the. In contradistinction to diseases of the secretory portion of the lacrymal apparatus, diseases of the excretory portion are of very frequent occurrence and are all characterized by the common and annoying symptom of tears' flowing over the cheek.

Anomalies of the Puncta Lacrymalia and of the Canaliculi.—*Congenital.*—Complete obliteration or absence of the puncta as well as double puncta has been occasionally observed. At times the puncta and canaliculi may be wanting, the canals being represented by narrow grooves along the edges of the lid.

Case of congenital epiphora of both canaliculi in one eye and of inferior one in other in child complaining of epiphora; hereditary origin. Lafite-Dupont. (Ann. d'Ocul., Apr., '95).

Acquired.—Such anomalies are usually the result of chronic inflammations of the lids and conjunctiva, which have disturbed the normal relationship existing between the puncta and the bulbar conjunctiva. They are frequently induced by old age, due to a senile relaxation in the orbicularis palpebrarum, and are constantly present in paralysis of the seventh nerve.

Two cases of dacryorrhœa caused by atresia of the puncta in consequence of spastic contracture of the sphincter. Seggel (Zehender's klin. Monat. f. Augenheilk., Sept., '90).

Secretion of tears due to the influence of a branch of the seventh pair. Triboudeau (Jour. de Méd. de Bordeaux, Nov. 3, '95).

Lacrymal gland supplied by the facial nerve. One-sided weeping is due to a paralysis of that nerve. The gland is only brought into activity in the act of weeping or in forced lacrymal secretion. Goldzieher (Revue Gén. d'Ophtal., Jan., '94).

Eversion of the punctum is almost a constant consequence of ectropion, and is also present in those rare cases when the eyeball is so deeply set that a triangular space intervenes between the lid and the globe.

Complete obliteration is a not infrequent result of burns and traumatisms which have involved the lids, and of granular conjunctivitis and blepharitis. Rarely, the canal may be blocked by a cilium or polyp, or by leptothrix.

Cylindrical grass-blade, one-half centimetre long, extracted from the upper canaliculus of a man. Rodionoff (Russkaia Meditzina, No. 8, '88).

Case in which abscess of the inferior lacrymal canal was found to be caused by a piece of lettuce-leaf 2 millimetres long and 1 millimetre in circumference. The foreign body had been driven into the nose and thence into the nasal duct by repeated efforts of sneezing. Malgat (Recueil d'Ophtal., Apr., '90).

Mass of actinomycoses removed from lower canaliculus of a healthy man. Huth (Centralb. f. prakt. Augenh., Apr., '94).

Symptoms.—The most common symptom of all these anomalies is the constant overflow of tears. This is annoying in itself, but, more than that, it frequently causes such irritation of the skin about the lids, that an inflammation is set up which causes contraction of the parts, and still further interference with the proper canalization of the tears.

Hyperæmia and catarrh of the conjunctiva are constantly present, consecutive to all forms of lacrymal obstructions.

Treatment.—Usually the simple dilatation of the punctum, or the slitting up of the canaliculus, is sufficient to effect a cure, with the co-operation of an astringent wash of zinc and boric acid.

In the treatment of lacrymal obstruction, the lower canaliculus is slit with a bistoury or scissors only to a distance of five millimetres from the puncta, and Bowman's sounds passed for eight days following. The triple-furrowed sound is introduced and allowed to remain in place during the remainder of the treatment, the instillation of a 1-per-cent. solution of zinc chloride being made along its capillary furrows. Libbrecht (Recueil d'Ophtal., May, '91).

Lacrymal obstruction often successfully treated by slitting upper canaliculus. Story (Ophthalmic Review, June, '95).

Literature of '96-'97-'98.

Hypnotism successfully used in a number of cases to pass lacrymal probes, and even for slitting up the canaliculus without pain. A. E. Davis (Post-graduate, Nov., '96).

If the condition has been brought about, however, by a high degree of ectropion, or is the result of an extensive burn, relief will be frequently difficult to attain, and extensive plastic operations may be necessitated before the lid is restored to its normal position.

Anomalies of the Lacrymal Sac and Nasal Duct.

Dacryocystitis or inflammation of the lacrymal sac may be either acute or chronic.

Symptoms.—The disease is rarely acute, but begins generally as a chronic inflammation, which manifests itself by a slight swelling and redness at the inner canthus, and by persistent and troublesome lacrymation, or by the discharge of a muco-purulent secretion from the inner canthus of the eye. Pressure on the sac will express a secretion which is either mucoid or muco-purulent, either into the conjunctival *cul-de-sac* or into the nose.

This condition of affairs may persist and the sac may become chronically disturbed, and give rise to a tumor of considerable size (lacrymal tumor, or mucocele). Frequently the inflammation assumes an acute form, and the region of the sac becomes swelled and reddened and a thick creamy pus forms in the sac, which is only expressed after some difficulty. The pain is intense, and there are marked constitutional symptoms, such as fever and loss of appetite. If the parts are undisturbed, the skin ulcerates and is perforated usually beneath the tendon of the orbicularis muscle, and a permanent fistula is formed. More rarely, the opening in the sac heals, and the formation of the fistula is avoided. As a result of the fistulous formation, pus frequently burrows into the deeper tissue, and necrosis of the neighboring bones is not rarely occasioned.

Etiology.—In the great majority of cases dacryocystitis is secondary to diseases of the lacrymo-nasal duct, primary inflammation of the lacrymal sac being an extremely rare affection. It is a disease of adults, being rare in children, when it occurs under 10 years of age being usually significant of inherited syphilis.

Seven cases of so-called blennorrhœa of the lacrymal sac in newborn infants. This condition can usually be accounted for by an atresia of the nasal opening of the lacrymal canal, caused by a failure of absorption of the embryonic tissues in this position. Avoidance of sounds is recommended; slight digital pressure over the sac, combined with frequent cleaning of the eye, will work a cure in a short time. Peters (Zehender's klin. Monats. f. Augenh., Nov., '91).

Acute dacryocystitis is a suppurative osteoperiostitis of the orbital process of the superior maxilla, and only secondarily implicates the sac. Fano (Journal d'Oculist. et de Chir., Apr., '91).

Case of dacryocystitis following slitting and probing of canaliculi; total blindness. Valude (Ann. d'Oeul., Mar., '95).

Fatal case of dacryocystitis caused by injection of 3-per-cent. solution of alum acetate into the canal. Leplat (Recueil d'Ophtal., Nov., '94).

Fifty cases of dacryocystitis. In 24 the affection was bilateral, and there was usually an interval of several months after the time of infection. Chauvel (Recueil d'Ophtal., May, '92).

Dacryocystitis occurs upon the left side more frequently than upon the right, and affects women oftener than men, appearing on the average toward the thirty-third year of age, and about six years after the beginning of epiphora. The predisposing cause is a depraved constitutional state. Variola has been found to have occurred previously in 41 per cent. Nasal affections — hypertrophic and atrophic rhinitis, deviation of the septum, and especially fœtid atrophic rhinitis—seem intimately associated with dacryocystitis. The bad condition of the teeth in many cases renders possible the propagation of periosteal inflammation from the jaw to the lacrymal mucous membrane. Purulent ophthalmia, as well as hereditary; direct traumatism, and osseous lesions contribute to the causes of dacryocystitis. Foucher (L'Union Méd. du Canada, Sept., '91).

Literature of '96-'97-'98.

Nasal condition examined in 94 cases of dacryocystitis showing that 89 had some nasal affection, whereas in only 5 was the nose healthy. E. Waggett (Ther. Monats., Dec., '96).

Examinations of the secretion from inflamed tear-sacs shows no one organism is found constantly in ordinary mucocele. Eyre (Ophth. Record, Nov., '97).

Treatment.—As inflammation of the lacrymal sac is dependent in most cases upon disease of the lacrymal duct, any obstruction existing there should be combated in the manner presently to be described. If this has been neglected, however, and an acute exacerbation has been inaugurated, hot applications should be

made to the tumor, and any pus evacuated by direct incision into the sac as soon as its presence is manifested. Calomel and quinine should be administered internally. If seen early, before this procedure is rendered impossible by the swelling of the parts, an entrance should be effected into the sac by slitting up the lower canaliculus, and the abscess-cavity washed freely with a solution of bichloride of mercury (1 to 8000).

Sodium fluoride, 0.5-per-cent. solution, recommended in dacryocystitis. Duclos (Archives Clin. de Bordeaux, June, '95).

Rhinalgin highly extolled in acute and chronic dacryocystitis. Rhinalgin is prepared according to the following formula:

℞ Alumol, 1/6 grain.
Ol. valerian, 3/8 drop.
Menthol, 3/8 grain.
Cocoa-butter, 15 grains.

Make one suppository.

Sig.: Use one morning and night in each nasal fossa. Thomalla (Centralb. f. prakt. Augenh., Aug., '95).

Ten-volume peroxide of hydrogen successfully used in an 8-year-old case of lacrymal abscess with fistula. McCullough (Canada Lancet, Jan., '92).

In blennorrhœa of the lacrymal sac in newborn infants, mechanical expression of the contents of the sac is, in many cases, unnecessary. Heddaeus (Zehender's klin. Monats. f. Augenh., Mar., '92).

Flexible sound of whalebone employed when the sac is the seat of obstruction. Suarez (Recueil d'Ophtal., May, '90).

If pericystitis is seen in the first two or three days, before suppuration be established, it may be aborted by a single catheterization. If suppuration is established, early incision advocated. Parinaud (Ann. d'Oeul., May, June, '91).

In lacrymal obstruction it is possible to thoroughly cleanse the lacrymal sac and to inject any desired application for the relief of inflammation of its walls through the dilated or enlarged punctum without slitting the canaliculus. Proper treatment of acute blennorrhœa of the sac, when seen early, should consist in the use of hot compresses and antiseptic injections. If the swelling is great and suppuration threatens, an incision into the sac advised, and, after slitting the canaliculus, the passage of proper probes. Risley (Jour. Amer. Med. Assoc., Sept. 17, '92).

Rapid cure of dacryocystitis by a free external excision into the sac. After curetting the sac a cannula, made of the decalcified femur of a large toad, introduced into the previously dilated nasal duct. Guaita (Ann. d'Oeul., Jan., '92).

Literature of '96-'97-'98.

Ten-per-cent. solution of zinc chloride preferred as the application in dacryocystitis. Frohlich (Klin. Monatsb. für Augenh., Jan., '96).

Stricture of the Lacrymal Duct.

Symptoms.—These are the same as in the first stages of dacryocystitis, and consist chiefly in obstinate lacrymation and in the ability to express a viscid matter into the *cul-de-sac* by pressure with the finger upon the lacrymal sac.

Two cases in which unsuspected obstruction of the lacrymal ducts has given rise to symptoms closely resembling the prodromes of glaucoma. Galezowski (Recueil d'Ophtal., Dec., '89).

Three cases in which stenosis of the lacrymal ducts was responsible for unpleasant symptoms of asthenopia. Trousseau (Recueil d'Ophtal., Feb., '90).

Stricture of the lacrymal duct is favored greatly by its relationships and by the anatomy of its parts. The mucous membrane which lines the bony walls of the canal is very vascular, and at certain parts is thrown into folds, which swell under slight provocation and offer sufficient obstacle in themselves to prevent the proper canalization of the tears. Again, the duct bears such a close relationship to the nose, that it is necessarily exposed to all inflammations of this cavity. Indeed, the great majority of cases of lacrymal obstruction are secondary to acute or chronic disease of the nose. This

is particularly true of nasal disease of syphilitic origin. As a consequence of its liability to inflammation by direct continuity of structure, the nasal end of the duct is the most frequent seat of stricture, the commencement of the duct at the extremity of the lacrymal sac offering the next most favorable site for the development of stricture.

Thirty out of thirty-five cases in which there was found, in chronic alteration of the lacrymal apparatus, an impairment of the nasal mucous membrane or a deflection of the nasal septum. Kruch (Annali di Ottalmol., No. 3, '88).

Four methods by which nasal disorders may lead to eye-symptoms and eye-lesions: 1. By processes of growth, causing extension of tumors through the sinuses into the orbit or into the cranial cavity, and hypertrophies involving mechanically the nasal end of the duct. 2. By extension of infection through lymph-vessels and foramina or deficiencies in the bony walls, or by continuity of surface; spread of inflammatory processes into the lacrymal sac and into the orbit, thus affecting the intracranial portion of the optic nerve. 3. By circulatory disturbances, which occur in the form of venous congestion whenever mechanical conditions exist in the nose which impede the circulation. 4. By nervous disturbances. Gradle (Jour. Amer. Med. Assoc., Sept. 10, '92).

Pneumococcus, a normal occupant of respiratory tract, may cause ocular trouble by infection through lacrymal passages or endogenetically. Cuénod (Ann. d'Oeul., May, '95).

Epiphora may result from an obstruction of the lacrymo-nasal duct from swelling of the mucous membrane, having its primary origin in chronic or subacute post-nasal catarrh, while the same symptoms may arise from atrophic changes with contraction, a part of a similar process in the intranasal passages. Lacrymal abscess may be traced to chronic pharyngitis, with involvement of the mucous membrane of the lacrymal duct, producing true stricture, interference with drainage, and development of pathogenic organisms. De Schweinitz (Cincinnati Lancet-Clinic, May 14, '92).

Infection of the conjunctival sac by bacteria from the nose is impossible by way of the lacrymal canal. Bach (Archiv f. Ophthalmologie, B. 40, H. 3, '94).

Ozæna is a frequent cause of disease of the lacrymal passages. Van Milligen (Archives d'Ophtal., Nov., Dec., '89).

Two cases of lacrymation caused by the presence in the mouth of decayed stumps of teeth, through induction of the chronic inflammation of the antrum and the nasal fossa, thence extending upward into the nasal duct. Puech (Rec. d'Ophtal., Nov., '95).

Literature of '96-'97-'98.

In scrofulous persons exostosis of the nasal duct is a cause of stenosis. Galezowski (Rec. d'Opht., No. 2, p. 166, '96).

Some cases of apparent closure of the nasal duct, with all the symptoms of dacryocystitis, are really due to the presence of groups of actinomycosis. Evetsky (Arch. d'Ophtal., Apr., '96).

Obstinate unilateral lacrymation in a newborn child usually signifies obstruction of the tear-duct. Landolt (Annales de Gyn. et d'Obst., Jan., '97).

Among the predisposing causes of diseases of the lacrymal passages are such defects of structure as flattening of the bony canal or other irregularities, and defects of refraction.

Syphilis, gout, phthisis, scrofula, or any of the infectious diseases may cause lacrymal disorder.

Among the local causes are conjunctivitis at the upper end of the lacrymal passage, and nasal disease at the other end, the morbid process in either instance spreading to the nearest canal. L. Conner (Jour. Amer. Med. Assoc., July 2, '98).

Treatment.—While an absolute and a complete cure of lacrymal obstruction may be frequently attained, more often relief is only partial. If the obstruction in the duct be due to swelling of the mucous membrane merely, the prognosis is good; but if the stricture be of bony origin it may be regarded as incurable.

Treatment may be either palliative or curative. The former consists in repeatedly pressing the contents of the lacrymal sac into the nose by the finger, and by the employment of antiseptic and astringent eye-washes, or by throwing a stream of boric-acid solution into the sac by means of an Anel syringe. Attention must be directed toward the nasal mucous membrane, and any local irritation existing about the nasal opening of the duct must be controlled with local applications.

In washing out the lacrymal passages, a hollow, conical cannula, which has its lower opening upon the side and a short distance above the terminal point, employed. Vignes (Recueil d'Ophtal., Mar., '91).

The curative plan of treatment resolves itself into some form of surgical procedure. These measures have been conveniently classed by Theobald under four heads: 1. Those which aim to restore the natural passages. 2. Those which have for their object the formation of a new passage into the nose for the tears. 3. Those which aim at the obliteration of the natural passages,—the lacrymal sac and duct. 4. The removal of the lacrymal gland for the purpose of arresting the secretion of tears.

The first step toward the restoration of the natural passages consists in the operation of Bowman, which consists in slitting up the lower canaliculus throughout its entire length. This is accomplished by entering a fine canaliculus-knife into the inferior punctum, and by slowly pushing it along the floor of the canaliculus, until it abuts against the inner wall of the sac as it rests against the lacrymal bone. The handle of the knife should now be swept upward, while an upward and slightly backward inclination is given to the blade of the knife. A ready entrance into the sac being gained by the successful accomplishment of this act, attempts should be made to engage the stricture, and to dilate its caliber by means of probes. I generally first make the attempt with a very small Bowman probe, and then gradually increase the size by passing slightly-higher numbers every second or third day. I am satisfied after a No. 6 probe, with a caliber of 1.50 millimetres, can be passed into the nose without difficulty. Larger probes are not employed, as they are apt to injure the mucous membrane and periosteum, and in some cases to lead to necrosis. Weber, Cooper, and Theobald, however, think sounds of the size of a Bowman No. 6 quite inadequate, and have devised probes of much larger caliber, employing instruments of a diameter of 4 millimetres in the treatment of the majority of their cases. As stated above, I am generally satisfied with a dilatation of 1.50 millimetres, and alternate the passage of probes by careful syringing of the duct with a weak solution of zinc and boric acid.

Routine slitting up of the canaliculi in every case demanding treatment of the lacrymal sac or nasal duct deprecated. Stenosis of the lower end of the nasal duct often can be relieved by the galvanocautery. Gillet de Grandmont (Recueil d'Ophtal., May, '90).

Lacrymal duct kept open by passing small-sized cannula containing probe through canal; cannula removed and split pea of lead fastened to one end of thread pulled up until its progress is arrested; second shot attached to upper end near punctum. Vilas (Med. Rec., June, '95).

Importance of examining the nasal passages after the passing of lacrymal probes, both in order to determine their position and to detect the presence of any abnormality which might tend to obstruct the lower end of the ducts. Cheatham (Amer. Pract. and News, Apr. 27, '93).

In stenosis of the nasal duct, method

recommended by Benson, which consists in the use of removable styles, introduced by the patient and worn during the night. Hasbrouck (Jour. of Ophthal., Otol., and Laryn., Apr., '90).

After first obtaining local anæsthesia by cocaine, electrolysis of the lacrymal duct may be effected by passing an ordinary Bowman probe into position, and then connecting the negative electrode of a battery with the handle of the probe by a serre-fine, and effecting continuity of circuit by forcing a small platinum tracheotomy cannula, to which the positive electrode of the battery has been fastened into the corresponding nostril so as to meet the probe. After this has been done, a larger-sized probe can be readily introduced. Gorecki (Archives d'Ophtal., Sept., '90).

Summary of methods of treatment of affections of the lacrymal apparatus: 1. Epiphora: astringent and antiseptic collyria. 2. Catarrh, with and without stricture: in the first case, catheterism by Bowman's probes, followed by injections of sublimate, 1 to 3000; in the second, the injections will suffice. Finally, extirpation of one or both parts of the lacrymal gland. 3. Suppuration of the sac: if acute, incision of the anterior wall, bichloride wash, and iodoform dressing; if chronic, treatment for blennorrhœa: and, if this fails, incision of the sac and cauterization of the mucous membrane with actual cautery. 4. Lacrymal fistula and fungosities of sac: thorough destruction, by thermocautery, of the sac and its surrounding tissue. 5. Alterations of the bony walls: opening, scraping, curetting, and cauterization. Specific treatment, if required. Lagrange (Gaz. Hebdom. des Sciences Méd. de Bordeaux, Sept. 20, Nov. 1, '91).

Literature of '96-'97-'98.

Use of large probes urged in the treatment of chronic cases of stricture of the lacrymal duct. G. M. Black (Phila. Med. Jour., July 16, '98).

One hundred and thirty cases of lacrymal stricture treated with the large probes until pronounced cured: 40 of these were kept under observation for periods varying from 1 to 8 years and relapse had occurred in only 2 cases. H. O. Reik (Phila. Med. Jour., July 16, '98).

In infants operative procedure should be postponed until palliative measures have been thoroughly tried, although in obstinate cases this may be successfully accomplished under a general anæsthetic.

Treating lacrymal blennorrhœas of the newborn by the introduction of a probe which is made equal to the thickness of a No. 3 or No. 4 Bowman, and which gradually tapers to a No. 1 Bowman, recommended. Weiss (Zehender's klin. Monats. f. Augenh., Jan., '89).

To prevent closure of the duct after it has been made patulous, a number of operators insert a leaden style, leaving this in position for several weeks or months. This is of especial value when the patients live at a distance, and cannot submit to the frequent and continued probing which is necessary to attain the best results.

Large probes employed in stricture followed immediately by insertion of a silver stylet into the duct. Fox (Times and Register, Dec. 9, '93).

In stricture of lacrymal canal, sounds employed, which were allowed to remain *in situ* six, eight, or even ten days. Plettinck (Recueil d'Ophtal., June, '94).

Literature of '96-'97-'98.

Treatment of stenosis of the lacrymal duct with permanent probes advocated. W. Vulpius (Archives of Ophthal., vol. xxv, No. 2, '96).

All organic strictures of the lacrymal passages treated by means of styles, in most cases permanently retained. The stem of a style should not be straight, except in the case of a very short duct, but somewhat concave outward. R. S. Miller (Brit. Med. Jour., Mar. 13, '97).

Other surgeons prefer rapid dilatation, and insert probes of the largest size into the duct at the first sitting, this being usually performed under ether.

Obstruction of lacrymo-nasal duct; rapid dilatation by immediate forcing with wide-lumen instrument. Goodman and Ziegler (Wills Eye Hosp. Reports, vol. i, No. 1, '95).

In intractable cases—as, for example, when the stricture is bony—two procedures have been practiced: the removal of the lacrymal gland and the obliteration of the lacrymal sac. The former of these has been modified by de Wecker, who excises the little lobules and the emissary ducts from both the subsidiary and main lacrymal glands.

Obliteration of the sac is but little practiced at present, but is best accomplished by means of the galvanocautery. If a fistula remain after abscess of the lacrymal sac, it may be healed by applying the galvanocautery to its freshened edges.

William Campbell Posey,
Philadelphia.

LACTATION. See Nursing and Infant-feeding.

LACTUCARIUM.—Lactucarium is the concrete milk-juice of *Lactuca virosa*, of the family *Compositæ*, a wild variety of lettuce growing in Europe. It occurs in irregular, brown lumps, which are wax-like internally when cut, and possess a narcotic odor and a bitter taste. It is soluble in alcohol, ether, and partly soluble in water. Lactucarium contains 58 per cent. of lactucerin (white, crystalline, and soluble in alcohol), lactucin (bitter principle in fine, white scales, and soluble in alcohol and 80 parts of water), and lactucic acid.

Preparations and Doses. — Lactucarium, 5 to 60 grains.

Syrupus lactucarii, $^1/_2$ to 2 fluidrachms.

Tinctura lactucarii, 10 to 60 minims.

Poisoning by Lactucarium. — Lactucarium is a feeble narcotic poison. When taken in overdose the symptoms are similar to those of opium poisoning. In the treatment of poisoning by lactucarium the same measures that are used in opium poisoning are indicated: the stomach should be evacuted if possible; the patient should be roused and kept moving; apomorphine, ammonia, coffee, douche, atropine, amyl-nitrite, artificial respiration, and electricity may then be used.

Therapeutics.—Lactucarium is chiefly used in slight irritation of the larynx to allay nervous irritability and in cases where there is an idiosyncrasy against opium. The syrup is used in cough-mixtures for children and delicate subjects. Aubergier's syrup and paste are active, uniform, and palatable. Lactucin may be used as an hypnotic and sedative in the dose of 1 to 2 grains.

LARYNGISMUS STRIDULUS. See Spasmodic Laryngitis.

LARYNGITIS AND KINDRED DISORDERS.

Definition and Varieties.—The term "laryngitis" means inflammation of the larynx: but to properly distinguish the various inflammatory disorders to which this organ is liable, several types of laryngitis are recognized: *Acute laryngitis*, in which the mucous membrane alone is supposed to be inflamed; *œdema of the larynx*, in which the deeper tissues become infiltrated; *symptomatic laryngitis*, in which œdema and phlegmon may complicate acute laryngitis as a result of microbic infection; *chronic laryngitis*, in which any of the lesions of inflammatory origin observed in the foregoing varieties have assumed chronicity. These types include several disorders to which individual names have been given, but they

appear to represent but stages or degrees of the classical forms.

Acute Laryngitis.

Symptoms.—Acute laryngitis in the majority of cases is the result of the temporary extension of a chronic catarrhal process existing in neighboring tissues, especially the nose, the pharynx, or the tonsils. In professional singers, for instance, constant traveling, with its attending variations in climate and temperature, frequent exposure to dust and smoke, etc., generally keep up catarrhal disorder of the naso-pharyngeal tract. The hyperæmia thus induced readily extends by continuity of tissue to the vocal organs under the influence of any undue exposure, dampness, cold, or any factor capable of irritating the laryngeal surfaces. The larynx in such cases may be said to be predisposed to a mild form of catarrh which appears more or less frequently. In such cases the subjective symptoms mainly consist in a constant desire to "hem" and a feeling of constriction at the throat. The voice is altered in quality and pitch; it becomes gruff, and hoarseness, more or less marked, follows. Under the influence of proper treatment and rest the local hyperæmia quickly subsides, but the continued use of the voice prolongs the inflammatory process and tends to permanently compromise the integrity of the organ as an instrument.

A laryngoscopical examination sometimes yields but little evidence of inflammation, the interarytenoid space alone showing slight hyperæmia. In the vast majority of cases, however, the entire larynx shows congestion, the vocal bands being distinctly red. Much faith cannot be placed upon these signs, in the case of male singers, however, the vocal bands being frequently pink and even red in the normal state; but in women, local redness usually means active congestion, unless the patient be addicted to excessive use of alcoholic drinks.

In persons in whom the voice is not subjected to more than ordinary uses, an attack of acute rhinitis frequently precedes the laryngeal disorder. When, however, the laryngitis is primary, hoarseness usually occurs as the first symptom, though slight chilliness occasionally alluded to is a premonitory sign. The voice is lowered in pitch, a pricking sensation is experienced in the larynx, which causes hacking and aggravation of the local congestion. There is usually some cough, slight dyspnœa, and occasionally some pain during deglutition. There may be a slight rise of temperature. The expectoration, at first jelly-like and viscid, becomes more copious. As this proceeds, the hoarseness becomes more marked and persists for some days, sometimes weeks.

When examined laryngoscopically the larynx is found markedly congested. The entire laryngeal membrane may be involved, or the congestion may be limited to the vocal bands and the intra-arytenoid tissues, the redness gradually fading off toward the upper portion of the laryngeal walls, except posteriorly.

Some cases of acute laryngitis are attended by hæmorrhagic symptoms, the expectoration of blood usually following violent coughing. Besides the usual laryngeal manifestations, there is generally to be found a circumscribed patch, the seat of rupture of a superficial vessel. In some cases there is no expectoration of blood, but the vocal bands show a red spot, or localized hæmorrhagic infiltration. It sometimes shows itself independently of a catarrhal condition as a result of undue strain in using the voice. It is probable, however, that a latent catarrhal process is always present in

such cases, and that the vascular walls are inordinately weak.

Case of acute hæmorrhagic laryngitis and record of several cases hitherto published. Cardonne (Il Progresso Medico, Apr., '88).

Hæmorrhagic laryngitis is an acute catarrh of the larynx, accompanied by hæmorrhage of the inflamed mucous membrane, owing to certain peculiar conditions, local or general. La Placa (Archivii Ital. di Larin., Oct., '88).

Case of hæmorrhagic laryngitis in a healthy woman, 30 years of age, two months gone in pregnancy. Attention called to the fact that three out of six cases reported by Strübing occurred in females during pregnancy or shortly after. Treitel (Deut. med.-Zeit., Feb. 9, '91).

Laryngeal hæmorrhage may be of rheumatic origin. Immobility of the vocal cord, with consequent huskiness, is one of the commonest manifestations of the larynx. G. Hunter Mackenzie (Edinburgh Med. Jour., Dec., '94).

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Laryngitis hæmorrhagica attributed to the great swelling and hyperplasia of the mucous membrane, the increase in size and number of the vessels, the lessened resistance of their walls, and the frequent and periodically increased blood-pressure from coughing, hawking, etc.

Every idiopathic laryngeal catarrh is entitled to be termed "laryngitis hæmorrhagica," which, without external cause, and with intact mucous membrane, is accompanied by hæmorrhages on or into the mucous membrane. S. Salzburg (Jour. of Laryn., etc., Oct., '97).

(See colored plate.)

The rheumatic diathesis predisposes to a disorder of the larynx simulating acute laryngitis, but differing from it in that local phenomena are usually less active objectively. The voice is used with difficulty and the pain is sometimes much more severe than that experienced in other inflammatory disorders. There is dyspnœa in the majority of cases.

Rheumatism of the larynx sometimes occurs in conjunction with general rheumatism. It is a serious disorder, particularly in singers; one or both of the cricoarytenoid joints may be involved in the inflammatory process, and permanent hoarseness often results.

In predisposed patients the rheumatic laryngitis may be for weeks or months the only symptom of rheumatism. W. Freudenthal (Jour. of Laryn., Feb., '95).

Case of a man, with acute generalized articular rheumatism, in whom there occurred, as the articular pains subsided, pharyngeal and laryngeal odynphagia, and pharyngeal dyspnœa. Luc (Annales des Mal. de l'Oreille, etc., Mar., '92).

Five cases of acute rheumatic cricoarytenoid synovitis following colds. Grünwald (Berliner klin. Woch., No. 26, '92).

If the cricoarytenoid articulation is affected in rheumatic laryngitis, it is doubtful if the corresponding vocal cord will ever regain its normal range of movement, and the voice may be more or less permanently affected. G. Hunter Mackenzie (Edinburgh Med. Jour., Dec., '94).

Etiology.—Generally speaking, laryngitis may be said to be due either to conditions causing local congestion by mere overuse or mechanical irritation, or by continuity of tissue.

The forms thought to be independent of specific germs are those due to exposure to cold and damp, the inhalation of smoke, especially tobacco-smoke in a badly-ventilated room, dust, irritating fumes, spices, irritating particles of all sorts, etc. Excessive use of the voice and the ingestion of alcoholic drinks, of hot or overspiced food are also frequent causative factors.

Nine cases of catarrhal laryngitis the result of bicycling, tricycling, etc. The disease is attributed to the improper position taken by these subjects in their exercise, inclining the body forward and thus impeding respiration and rendering it necessary to respire by the mouth as

well as the nose, while the rapidity of the pace drives the air into the larynx and lungs under increased pressure. Ragoneau (Revue de Laryn., etc., Nov. 15, '91).

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Case of acute laryngitis caused by potassium iodide. Contrary to the other recorded cases of a similar character, it was not a simple œdema, but an intense hyperæmia and infiltration of the mucous membrane and of the submucous tissue. Frankenberger (Therap. Monats., vol. xii, No. 4, '97).

As already stated, catarrhal diseases of nose and naso-pharynx greatly predispose to acute laryngitis, and the majority of cases witnessed show such a condition as a primary factor. Singers, army-officers, ministers, etc., are especially prone to this disorder on this account, particularly when the voice is improperly used; but the presence of a primary catarrhal disorder of the naso-pharyngeal tract may usually be discerned.

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Catarrhal affections of the larynx are always secondary to nasal and pharyngeal catarrh. The exceptions to this rule are where the larynx has been locally irritated by the inhalation of irritant gases or by sprays of too strong a solution. One other exception is seen in public speakers, actors, and singers. Rice (Post-grad., May, '98).

Pathology.—In the idiopathic form of acute laryngitis the superficial vascular supply is mainly at fault and there are very few cases in which a certain amount of cellular infiltration does not occur, and the line of separation between the superficial and deeper changes is not easily discerned. The primary factor in such cases is probably vasomotor, and if the paresis of the vascular nerves is marked the serous infiltration by diapedesis into the tissues may be such as to give rise to slight tumefaction. The epithelium may be softened and localized, desquamation occurring; diminutive erosions are sometimes found.

Treatment.—The patient should remain in a warm room, refrain from talking and smoking, and not allow others to smoke around him. Hot food increases the local congestion and especially the hot alcoholic drinks so frequently indulged in. Cracked ice and ice-cream are usually grateful to the patient and beneficent to his throat.

An acute attack of laryngitis due to "cold" may often be arrested by the early internal use of bromide of potassium and opium. Twenty grains of the former, with 2 drachms of paregoric, repeated every three hours usually reduces the laryngeal hyperæsthesia which lies at the bottom of the local symptoms to a minimum, while the likelihood of any complication is greatly decreased. The somnolence also induced tends to reduce the localized congestion. After this effect is obtained, the dose may be reduced by half and taken every two hours, two or three times. A bottle of citrate of magnesium taken the next morning often brings on the stage of resolution. This may be encouraged by means of the official compound guaiac lozenges.

In some cases the inhalation of steam impregnated with the compound tincture of guaiac is quite effective, but not nearly as much so as the method given above, which it is calculated to replace, when patient cannot take the bromides. One teaspoonful of the compound tincture is placed in a pitcher of water as hot as obtainable; the vessel is covered with a towel folded into the shape of a cone; the mouth and nose are inserted into the open top of the cone, and the steam is inhaled deeply as long as it is emitted.

The inhalation of steam charged with the compound tincture of benzoin is preferred by some clinicians. It may be employed in the same manner as the tincture of guaiac.

Literature of '96-'97-'98.

Apomorphine, $^1/_{30}$ grain, in freshly-compounded acidulated mixture, recommended as a most efficient relaxing expectorant in acute laryngitis. Thomas Hubbard (N. Y. Med. Jour., July 18, '96).

The syrup or infusion of the leaves of erysium has proved of great value, not only in restoring the quality of the voice, but in reducing the evidences of inflammation in cases of simple acute laryngitis. In 20 such cases, 3 doses daily, consisting of 15 drachms of the syrup in an infusion representing 7 $^1/_2$ drachms of the leaf, has removed all the functional disturbance in forty-eight hours. Hermary (Presse Méd., Nov. 20, '97).

Inhalations by means of an atomizer of a cold 2-per-cent. solution of ichthyol repeated twice daily, and not too deeply inspired for fear of producing nausea and vomiting, have given excellent results in acute laryngitis. Cieglewicz (Vrateh, xix, No. 8, '98).

In many cases the local disorder is greatly influenced by general disorders. In female professionals, especially, constipation is almost the rule, owing probably to their irregular mode of living, their varying diet, and the continued traveling in railroad-cars. Purgatives, even mild aperients, are, for obvious reasons, out of the question when evening after evening the sufferer is to appear upon the stage. Enemata, while being immediately effective, present the advantage of not diminishing the patient's strength. An enema composed of one pint of lukewarm water and a tablespoonful of glycerin will sometimes be found to act surprisingly, not only on the intestines, but on the voice, especially if, as is often the case with traveling artists, the bowels have not been moved for several days. If fever is present, drop doses hourly of tincture of aconite will usually reduce it markedly.

In cases in which the bromides and opium cannot be given, a solution of resorcin or alumnol, 7 grains to the ounce, should be used with an atomizer about every two hours the first day, then three times daily. To enable the solution to thoroughly bathe the bands, the voice should be sounded during inhalation, while the fluid is being sprayed in, the bands being thus brought in and forming a floor, as it were, at the lowest portion of the larynx. When the hoarseness is great, an application with cotton pledget of carbolized iodotannin or a solution of perchloride of iron, 20 grains to the ounce, causes a sudden contraction of the capillaries, which is effectively maintained by the resorcin solution.

To hasten the process of resolution, a pill composed of 1 grain of quinia and $^1/_4$ grain of nux vomica, administered every two hours the first day, then four times a day. Mariani's coca-wine, a wine-glassful being taken every three hours during the day, is especially effective in this connection, but the last dose must be taken at least three hours before using the voice professionally.

In the treatment of rheumatic disorders of the larynx local measures are practically useless. The benzoate of sodium is sometimes quite effectual, 5 grains being given every three hours. Salicylate of sodium is the standard remedy when it can be tolerated. (See RHEUMATISM.)

Œdema of the Larynx.

Œdematous infiltration of the larynx may occur as the result of a simple catarrhal process, of traumatic laryngitis, or as a complication of infectious disorders, proximate or remote.

Symptoms.— The first manifestation

may be a chill, soon followed by hoarseness and laryngeal pain. The most prominent symptom experienced almost from the start is a sensation of constriction at the throat and gradually increasing dyspnœa, most marked during inspiration. There is also local heat, dryness, and a muffled cough, which the patient aggravates by efforts to rid the surfaces of a supposed secretion. There is increasing huskiness, both inspiration and expiration being finally impeded. In favorable cases there is a gradual decline of all symptoms; but this course is not always observed, and, unless prompt relief is afforded, the patient dies of asphyxia. The temperature is not, as a rule, much above the normal.

> Nine cases of acute laryngitis sufficiently grave to cause dyspnœic recession of the chest during inspiration. The pulse invariably became small during the same period. As the disease progressed, the symptom became more and more marked until, just before tracheotomy was done in the cases requiring it, the pulse was found to be almost imperceptible during inspiration. The moment the trachea was opened and air allowed to freely enter the chest the pulse resumed its regularity in volume and rhythm. Brockbank (British Med. Jour., June 24, '93).

> Case of acute œdema characterized by the following features: (1) the absence of any known causative agency and constitutional symptoms; (2) the extent of œdema which may occur without marked dyspnœa; (3) the peculiar character of the voice; (4) the marked benefit of prompt treatment without scarification; (5) the possibility of the case's belonging to a group of obscure clinical manifestations known as angioneurotic œdema or allied vasomotor phenomena. J. H. Pryor (Med. Record, July 28, '94).

The laryngoscopical examination reveals local changes varying with the cause of the œdema. When the latter is secondary to acute laryngitis, the upper portion of the larynx over which the tissues are comparatively loose are swelled and red or reddish yellow. The epiglottis sometimes appears as a thick cushion, covering two sausage-like bodies under it, the aryepiglottic folds. As the tissues swell, these tend to roll inward, forming a series of cushions whose edges gradually approach one another, steadily reducing the lumen of the laryngeal cavity. When the œdema is the result of traumatism or contact with corrosive acids, etc., there is great redness and supplementary local lesions. Marked inflammatory swelling also attends the erysipelatous form.

When œdema is due to a general disorder, the mucous membrane is, as a rule, paler than when it occurs as a complication of a local inflammatory process.

> In œdema of the entrance of the larynx the passage to the glottis is obstructed most especially by swelling of the inner layer of the aryepiglottic folds, which lie like two morbid growths upon the ventricular bands, and thus become a great impediment to respiration. Hajek (Archives Gén. d'Hydrol., etc., B. 42, H. 1, '91).

In œdema occurring as a result of inhalation of steam, fire, caustic vapors, or to the deglutition of too hot liquids, or corrosive substances taken accidentally or with suicidal intent, such as carbolic acid, sulphuric acid, etc., the onset of the symptoms is comparatively sudden. Dyspnœa and spasm sometimes occur from the start, and all the symptoms of acute laryngitis enumerated are increased in intensity. The gravest local manifestation of laryngeal inflammation, œdema, is soon reached. In the majority of cases met with, however, after a series of acute manifestations, momentary dyspnœa and laryngeal spasm, etc., which the physician does not, as a rule, witness,

the larynx assumes a comparatively normal condition, as far as the patient goes, though, however, the laryngeal structures become infiltrated and after a few hours—sometimes an entire day—the most distressing symptoms appear, and the patient dies asphyxiated, unless relieved. (*See colored plate.*)

The upper portion of the larynx may show evidence of tissue-destruction when such agents as carbolic acid, ammonia, etc., have been used; but in the majority of cases laryngoscopical examination only reveals intense redness of all the laryngeal tissues, with slight swelling. The active congestion may be localized, this depending upon the causative agency. In laryngitis due to burning fluids the epiglottis may alone be involved, but in the vast majority of cases neighboring pharyngeal tissues, the interarytenoid space, the ventricular bands, and the vocal bands take part in the inflammation.

Etiology and Pathology.—The œdema occurring as a result of simple catarrhal laryngitis is usually brought on by undue exposure to damp cold air while the body is overheated by violent exercise, such as dancing, fencing, etc. *Décolleté* gowns and the luxury of sitting at an open window after dancing, and drinking of ice-water, have thus caused many victims—sudden deaths credited to heart disease.

> Two cases of œdematous laryngitis requiring tracheotomy, both caused by drinking ice-water when the patients were in an overheated condition. Vladimir A. Paduecheff (Trans. Ural Med. Society, p. 26, '92).
>
> Case of œdema of the epiglottis, the result of a chill while the patient was on duty at a railway-station. Tracheotomy was necessary. The patient recovered. F. Taliaferro (Chicago Med. Jour. and Examiner, Sept., '88).
>
> Case of œdematous laryngitis following cold, in a vigorous soldier. Tracheotomy became necessary. L. Dorange (Archives de Méd. et de Pharma. Milit., July, '92).

Œdema of the larynx has also been observed in cases treated with iodide of potassium, the connection between the disease and drug being shown by the reduction of the œdema when the drug is withdrawn. (See IODINE, in this volume.)

> Two cases of œdema due to iodide of potassium. The first was a carcinoma of the larynx, in which an antisyphilitic treatment was instituted to eliminate the possibility of syphilis. After about 15 grains of iodide of potassium had been taken, laryngeal œdema developed to such an extent that a tracheotomy was required. In the second case, which was thought to be syphilitic, the epiglottis, arytenoids, and ventricular bands were œdematous, and the patient suffered from dyspnœa. On administering iodide of potassium for a day or two, the œdema and dyspnœa increased. After leaving off the iodide of potassium the œdema quickly improved in both cases. The remedy was administered later in the second case, without causing œdema. Schmiegelow (Archiv f. Laryn., vol. i, No. 1, '93).

It is probable that a latent disorder of the larynx is present in such cases. This may have existed before the use of the iodide or occur as a result of the disease—syphilis, for instance—for which the drug has been administered. Lesions of the kidney may mechanically induce laryngeal œdema by interfering with the free elimination of fluids.

> Œdema of the larynx may be a diagnostic sign of disease of the kidney. Abate (Med. Bulletin, Oct., '95).
>
> Three cases: (1) œdema of epiglottis as the first symptom of chronic nephritis; (2) acute œdema of right arytenoepiglottic region, apparently due to traumatism from a piece of bread; (3) œdema of epiglottis and laryngeal vestibule in a case of variola, with scarification and recovery. A. Bandler (Präger med. Woch., vol. xiii, No. 19, '88).

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Inflammatory disorders of the larynx (Robert Krieg)

1 Acute Laryngitis 2. Acute inflammation of epiglottis 3 Acute inflammation of Ventricular Bands
4 Hæmorrhagic Laryngitis 5 Early stages of œdema

Atlas der Kehlkopfkrankheiten F Enke Publisher Stuttgart

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Literature of '96-'97-'98.

Existence established of an early syphilitic œdema of the larynx, independent of all ulceration or erosion, and itself the solitary notification that the specific virus has attacked that organ. Lacroix (Archives de Laryng., Nov. and Dec., '97).

Acute œdema of the larynx in two cases due to iodide of potassium: 1. Case of pulmonary laryngeal phthisis. Five days after potassium was begun a considerable œdema of the left arytenoepiglottic fold was noticed, which disappeared when the iodide was discontinued. 2. Case in which patient was given potassic iodide for syphilitic manifestations. After two weeks there was coryza and dyspnœa and œdematous swelling on the right side of the larynx. The iodide was omitted, and the swelling disappeared. The œdema was unilateral in both cases, a feature not often met with in cases hitherto recorded. Stankowski (Münch. med. Woch., Mar. 23, '97).

As the cause of œdema of the larynx is more thoroughly studied the cases that cannot be ascribed to either some pre-existing local affection in either the pharynx or the larynx or to some constitutional disease or external irritation will be exceedingly rare. C. C. Rice (N. Y. Med. Jour., Dec. 3, '98).

Many of the cases of œdema of the larynx are thought to be of infectious origin, exposure of the parts to weakening influences of cold, etc., facilitating the entrance of micro-organisms of neighboring inflammatory processes, particularly of the naso-pharynx. The base of the tongue, the mouth, and the tonsils are known to be sources of infection.

Acute primary œdema of the larynx is an infectious disorder, streptococci and pneumococci having been found in several cases of that affection. Cold and traumatisms considered as but occasional causes favoring the penetration of germs into the organism. F. Barjon (Gaz. des Hôp., May 19, '94).

Case of a man in whom, shortly after removal of a loose bicuspid tooth, cellulitis of the face and neck developed. Œdema of the pharynx developed, and afterward œdema of the larynx. Laryngo-tracheotomy performed. Symes (Dublin Jour. Med. Science, Aug., '92).

Case of secondary œdema of the larynx, following suppuration of a deeply-seated gland in the region of the carotid artery. Extirpation of the lymphatic gland produced immediate marked relief. Addeo Totti (Lo Sperimentale, Mar. 15, '92).

Inflammatory disorders of the glands of the neck, parotitis, tonsillitis, etc., may thus suddenly be complicated with œdema of the larynx with its attending dangers.

Case of sudden death probably from œdema of the glottis, in a healthy lad 17 years of age, with unilateral tonsillitis. Francis Minot (Boston Med. and Surg. Jour., Dec., '90).

Case of œdema of the larynx resulting from pyæmia, which seemed to have followed the introduction of a sound to relieve a urethral stricture following gonorrhœa. J. H. Bryan (Med. News, Feb. 6, '92).

Burning or scalding of the larynx, traumatisms,—such as those induced by the passage of foreign bodies, sharp bones, tacks,—etc., may, as stated, also act as etiological factors. Even alcohol has been known to produce localized œdema.

Case of œdema of the larynx reported, the location of which was not defined, due to the action of raw spirit poured into a woman's mouth while she was in a state of syncope. The patient recovered. G. H. Darwin (Brit. Med. Jour., Jan. 14, '88).

Œdema of the larynx comprises all cases in which the œdema is a consequence of another local or general process; no inflammatory reaction is present; the etiological factors include Bright's disease, cardiac affections, venous stasis, anæmia, and general hydræmia and angioneurotic processes. Kuttner (Virchow's Archiv, Jan. 4, '95).

Records of autopsies made under charge of Virchow, between 1873 and

1878, examined by Peltesohn gave the following results:—

In 3887 examinations, œdema of the larynx was noted 210 times,—149 in men, 40 in women, and 21 in children. Forty-four cases had occurred in regional disease and 166 in systemic disease. Of 5161 patients treated in the clinic for diseases of the throat and nose, between April 1, '87, and June 1, '89, there were only 8 with acute œdema of the larynx, —7 in men between 21 and 48 years of age and 1 in a woman 58 years of age.

Prognosis.—Œdema of the larynx is at times so rapidly fatal that no warning of the oncoming issue is afforded. A patient suffering from slight hoarseness on retiring may thus be found dead next morning. Though such cases are comparatively rare, they nevertheless show the importance of promptly attending to acute laryngeal maladies. When the iodides are being administered in connection with throat disorders, the larynx should be frequently examined laryngoscopically.

Cases in which the infiltration is localized are obviously less likely to prove mortal than those involving all the tissues. The latter form is that most frequently met with when general disorders —such as scarlet fever, typhoid fever, variola, etc.—act as the primary factor.

Sestier found that the affection proved fatal in 158 out of 213 cases in spite of tracheotomy performed thirty times. In the 55 cases which recovered tracheotomy was performed twenty times. Bayle reports 17 cases with 16 deaths. F. E. Hopkins (Med. Record, Oct. 19, '95).

Treatment of Œdema of the Larynx.—When œdema is present vigorous measures should be adopted when dyspnœa becomes evident. Until then, cracked ice should be kept in the mouth and cold-water compresses applied around the throat. The patient should be well covered and given a hot mustard foot-bath, then immediately placed in bed, but in the sitting posture, and wrapped in blankets—the object being to cause normal diaphoresis. If this cannot be obtained normally, pilocarpine should be given hypodermically, or internally if the local manifestations are not marked.

The bromides are useful in reducing the local infiltration, and a dose of 20 grains in an adult, repeated as often as needed, sometimes proves very efficacious.

Pilocarpine injected hypodermically proves very efficacious in reducing laryngeal œdema. Six drops of a 5-per-cent. solution of the alkaloid, repeated three times at intervals of fifteen minutes, caused complete relief in the cases reported. Suarez de Mendoza (Revue de Laryng., Aug. 15, '91).

Application of leeches to the front of the neck is very effective in acute and primary laryngeal œdema. Levi and Laurens (Archiv. Gén. de Méd., Dec., '95).

If a case be seen at the beginning of an attack, the treatment consists of inhalation of warm medicated vapor, the use of diaphoretics, the maintenance of the patient's room at an equable temperature (72° F.), with the air moistened by the vapor of boiling water, and at a later stage the application of leeches over the region of the larynx, to be followed by the continuous use of the cold coil. The sucking of pellets of ice is also to be recommended. Upon the appearance of œdema, however, scarification with the laryngeal lancet should be performed. F. E. Hopkins (Med. Record, Oct. 19, '95).

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Acute submucous laryngitis in children, characterized anatomically by submucous infiltration, bearing a misleading resemblance to acute œdema, is manifested clinically as a suffocative catarrh.

A point of particular diagnostic importance is the association of an unimpaired voice with a hoarse cough. Intubation is indicated when retraction is marked. Castaneda (Jour. of Laryn., Rhin., and Otol., Apr., '97).

In a case of acute idiopathic œdema of the epiglottis in a man of 41, a spray of ichthyol, 1/3 per cent., in ice-water every fifteen minutes, with ice externally, gave rapid relief. W. P. Meyjes (Jour. of Laryn., etc., Mar., '97).

Tincture of belladonna, 5 drops every hour until its physiological effects become marked, also tends to counteract the infiltration by contracting the laryngeal blood-vessels.

Astringent solutions should only be used in circumscribed œdema, a weak solution of tannin, alumnol, or resorcin being valuable in such cases. When the cases can be closely watched, a 10-per-cent. solution of cocaine applied directly to the larynx causes momentary—though slight—retraction of the tissues, and may thus be advantageously used especially when surgical measures are to be resorted to: scarification, intubation, or tracheotomy. In some cases, however, it seems to increase the dyspnœa.

When the dyspnœa becomes urgent, scarification of the laryngeal tumefaction is indicated. With the assistance of the laryngeal mirror—held in the left hand—the procedure is quite easy after anæsthetizing the laryngeal tissues with a 10-per-cent. solution of cocaine. The pocket-case curved bistoury is wrapped in a piece of bandage held in place with thread up to within an eighth of an inch of the tip, to prevent cutting the tongue with edge of the blade. The tongue being drawn out and held by the patient, the epiglottis will generally be seen standing erect, and looking, when much infiltration exists, not unlike a pale cherry. This should not be punctured first, as the patient may refuse a second incision and the first should be the most profitable one to him. The portion playing the most important part in the production of the dyspnœa is the aryepiglottic fold, and this can usually be depleted by means of a short incision into its external border, thus causing the blood and serum to flow into the pyriform sinus, instead of into the larynx proper. When the patient is docile, both sides can be scarified and the epiglottis also, care being taken to prick the edges with the point rather than the internal aspect of the laryngeal walls.

When a laryngoscopic mirror is not at hand, the index finger of the left hand should be passed behind the epiglottis and used as guide for the curved bistoury.

At times scarification even when thoroughly carried out, does not relieve the dyspnœa. In that case the lower portion of the larynx and the tissues beneath the vocal bands will probably be found involved in the inflammatory process, when examined laryngoscopically—if seen at all. Under these circumstances either intubation or tracheotomy must be resorted to. (See INTUBATION and TRACHEOTOMY.)

In acute circumscribed œdema of the larynx scarifications should be made. Landgraf (Jour. of Laryn., Apr., '94).

In the early stages of primary œdema cold applications externally, broken ice, and tannin; later on hot fomentations should be applied to the neck. The respiratory difficulty often yields to ether or sodium bromide with syrup of chloral. Insufflation of tannin solution is more valuable in serous than inflammatory œdema; in the latter pilocarpine injections are preferable. Scarification condemned. Tracheotomy preferred to intubation, since the passage of the cannula in the latter case is often stopped by the œdema. Attention must be paid to the general condition. L. Bar (Allg. Wien. med.-Zeit., Aug. 11, 18, 25, '96).

When laryngitis is due to traumatism and the manifestations are not sufficiently marked to require operative measures, considerable pain is sometimes present: again, the lesion is so exposed that infection may occur, a benign process thus being transformed into a severe

one. The most satisfactory results are to be obtained by strict cleanliness through the use of a 5-grain solution of borax applied with the atomizer, the laryngoscopical mirror being employed to properly locate the spray. Two grains of pure iodoform are then applied with the insufflator. This reduces the pain and curtails the infectious process in any form of laryngitis in which these elements prevail.

Symptomatic Laryngitis.

This term is sometimes applied to the laryngeal manifestations occurring in the course of general diseases, and involving, as a rule, the deeper structures. The symptoms vary with the intensity of the local manifestations, and may range from those of a simple laryngeal catarrh to the most severe œdema calling for immediate tracheotomy. Complications of so dangerous a nature are fortunately rarely witnessed.

Measles is usually attended by inflammatory involvement of the larynx. There is hoarseness and sometimes loss of voice, the symptoms, in fact, being quite those of acute laryngitis, including occasionally slight tumefaction.

The laryngoscope reveals a condition similar to that of the skin, the exanthem showing itself more or less clearly. Red spots project from the surface, giving it an irregular appearance. The process of resolution usually progresses without complication. Occasionally, however, œdema or ulceration occurs as a complication.

> Case of acute laryngitis in measles in which the vocal bands became completely destroyed by ulceration, which had extended upward to the ventricles and downward for nearly 1/4 inch (6 millimetres), penetrating apparently down to the cartilages. L. Emmett Holt (Med. Record, June 22, '89).

Variola and Varicella.—The laryngeal manifestations of variola are various. In some cases small pustules are observed; these may gradually develop into a necrotic process, leading to perichondritis and even œdema. The symptoms are those of acute laryngitis. The intensity of the local disorders varies with the gravity of the general disease, but, as a rule, the course is a benign one.

In varicella laryngeal symptoms are not as frequently observed as in variola, but they sometimes assume as serious proportions. Deglutition, phonation, and respiration may be seriously impaired, the latter resulting mainly from the smallness of the larynx in children.

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> In varicellous laryngitis the symptoms are those of croup. The specific character of the disease is very clear, there being small circular ulcerations on the vocal cords, and often on the epiglottis. Harlez (Jour. de Méd., June 25, '97).
>
> Autopsy of a case of varicellous laryngitis in which there was found gangrene of the edge of the epiglottis, a strip of slough on the free borders of the vocal cords. A crateriform erosion on the velamentous portion of the left vocal cord. A varicella-spot on the mucous membrane of the left pyriform fossa. Roger and Bayeux (Presse Méd., Apr. 10, '97).

Scarlet Fever.—In this disorder more or less marked involvement of larynx is frequent. In the vast majority of cases, however, the cause of the trouble is benign, and resolution occurs along with the general malady. The exceptions inferred may at least simulate various grave disorders, such as diphtheria and membranous laryngitis. Œdematous infiltration is also occasionally witnessed, and likewise constitutes a grave complication. In all these disorders the tendency to ulceration is markedly increased, and, when this starts, it is checked with diffi-

culty. Perichondritis and hæmorrhage owed to destruction of blood-vessels are always to be feared in such cases.

Erysipelas.—There is a form of acute laryngitis, closely associated with, if not an actual manifestation of, *erysipelas* of the larynx. This is a dangerous form, often accompanied by œdema, high fever, great hoarseness, and dyspnœa almost from the start.

> Infectious phlegmon of the pharynx and the larynx should be differentiated from erysipelas. Dysphagia, albuminuria, splenic engorgement, and in many instances delirium cited as the special characteristic indications of the malady. P. Merklen (Le Mercredi Méd., Nov. 12, '90).

Typhoid Fever.—The laryngeal complications of typhoid are to a certain degree typical in the fact that they are circumscribed in the great majority of cases. The parts that most frequently show erosions are the laryngeal surface of the epiglottis near the edge, the ventricular bands, and the upper part of the arytenoid space, the specific character of the complication being thus readily shown. The various ulcerative processes noted in scarlet fever are also occasionally observed in typhoid fever, the tendency to spread being equally marked. The destructive process may not only present itself during the progress of the general affection, but at some time after.

> The lesions may appear during two periods of the malady. In the beginning laryngitis is very common and ordinarily benign, rarely penetrating into the deeper tissues. It is during convalescence, two months after the commencement of the malady, that a severe form of laryngitis may be developed, a form fatal in the absence of prompt relief by tracheotomy, and leaving deformities which necessitate the indefinite retention of the cannula. These lesions usually involve the arytenoid, epiglottic, and cricoid cartilages. Peter (L'Union Méd., Mar. 10, '91).

> Catarrhal laryngitis, œdema of the glottis, perichondritis, may all be seen. The last-mentioned lesion may give rise to most wide-spread results in the direction of stenosis, besides its immediate dangers from necrosis of the cartilages and the like. From the intense prostration and apathy of the later period of typhoid these may go for some time unnoticed and progress untreated. The presence of Eberth's bacillus in the sputum noted and also in sections of the mucous membrane of the larynx in a fatal case of typhoid, showing that the laryngeal lesion is of a specific character, and not due simply to the general effects of the fever. The importance, in cases of typhoid in which there is any suspicion of laryngeal symptoms, of examination with the laryngoscope emphasized. Lucatello (Gazzetta degli Ospitali, No. 132, '93).

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> In post-mortem records of St. Bartholomew's Hospital of sixty-one cases of typhoid fever, fourteen showed loss of substance in the larynx. The larynx had not been examined; assuming that the larynx had been examined in all the remaining fifty-three cases, which is doubtful, ulceration was found in 26 per cent. of the fatal cases. These defects are situated generally over the tip and edges of the epiglottis and in the neighborhood of the processus vocalis. The lesions are caused by micro-organisms; there is the strongest evidence that these are the pyococci, and not, except rarely, the typhoid bacilli. Kanthack and Drysdale (Jour. of Laryn., etc., Apr., '96).
>
> When ulceration of the larynx is noted in typhoid fever it is not necessarily typhoid in nature. The ulceration in some of the larynges obtained at autopsies of persons dead from typhoid fever are found under the microscope to be of a tubercular nature. Jobson Horne (Jour. of Laryn., etc., Apr., '96).

Pertussis.—In whooping-cough the laryngeal manifestations are sometimes quite marked, but they are not attended, as in other diseases, by ulcerative processes. The severe cough induced occa-

sionally causes marked congestion of the interarytenoid space, accompanied, at times, by extravasation and localized hæmorrhage. Slight œdema is frequently observed. Diphtheria as a complication has been witnessed, though very rarely. The most annoying feature in connection with the larynx is a resulting hyperæsthesia of the interarytenoid space, which may persist indefinitely, the patient being subject to exacerbations of coughing when using his larynx any length of time. A dry, warm, or dusty atmosphere is also likely to cause considerable inconvenience. This sequel is especially apt to occur in adults.

Influenza.—The laryngeal complications of influenza generally occur in the cases in which symptoms affecting the upper respiratory tract are observed. There is the tendency to hæmorrhage; ulceration is also occasionally observed. Spasmodic cough is also present, causing considerable distress to the patient by greatly increasing the intensity of the frontal cephalalgia. Œdema of the larynx is occasionally met with, but, as a rule, it does not assume grave proportions.

Three cases of œdema of the larynx following grippal laryngitis. Bavachi (Gazette Méd. d'Orient, June 30, '91).

Disease of the upper air-passages is not uncommon coincidently with attacks of influenza. The usual form is a sanguineo-purulent inflammation of the pharynx, frequently extending upward into the dome of the pharynx and nasal cavities, and downward into the larynx and trachea. S. H. Chapman (N. Y. Med. Jour., Dec. 10, '92).

Laryngeal manifestations are frequent in influenza. Generally there is simply a catarrhal inflammation, but serious complications may occur,—ulcers, erosions, paralysis, œdema. Two cases of œdema witnessed in the Necker Hospital. The œdema affected the arytenoids and ventricular bands, and dyspnœa was marked, but not so great as to necessitate tracheotomy. Natier had seen two cases of influenza complicated with laryngeal œdema of the cords, which disappeared upon applications of nitrate of silver. Cartaz (Journal of Laryn., June, '93).

Typhus Fever.—In this disease the manifestations are similar to those in typhoid fever and the complications are also liability to ulceration, œdema, or pseudodiphtheria.

Case of laryngo-typhus. Beginning with hoarseness due to acute laryngitis, with ulceration, dyspnœa soon follows, demanding tracheotomy. If the patient recover, the local disorder, perichondritis, cricoarytenoid ankylosis, etc., will likely cause the wearing of the cannula to become permanent. Tissier and Bellit (Ann. de Méd. Therm., Dec. 21, '92).

Schech includes under the name of "laryngitis exudativa" a series of affections of the laryngeal mucous membrane in which there is exudation with more or less fluid contained in vesicles or bullæ, or hyperæmia with swelling. In *miliaria* there are vesicles on the epiglottis and aryepiglottic folds, giving rise to the sensation of a foreign body. *Herpes* very seldom occurs alone in the larynx; there is usually an implication of skin or of mucous membrane.

Acute inflammation of the tongue, floor of the mouth, and larynx may be due to herpes. Two cases clinically indistinguishable from angina Ludovici, which after death were found to be associated with, if not due to, trichina spiralis and miliary tuberculosis, respectively. S. Mackenzie (Brit. Med. Jour., May 18, '94).

Herpes of the larynx only occurs as one of the localizations of herpetic fever; its most frequent seat is on the posterior surface of the epiglottis and the region of the arytenoids. The herpetic vesicles are surrounded by an inflammatory zone. There is odynphagia, dysphonia, possibly dyspnœa. Brindel (Revue de Laryn., d'Otol., et de Rhin., Mar. 15, '95).

Schech also groups under the same head *foot-and-mouth* disease (stomatitis

epidemica) accompanied by more or less constitutional disturbance and by vesicles in the larynx, which break down into ulcers; *aphthæ*, which sometimes occur in the larynx in association with aphthæ of the mouth or vulva; *pemphigus*, which occasionally forms exudative swellings in the larynx, but the disease is rare in this organ. *Urticaria* also occasionally affects the laryngeal mucous membrane, and the symptoms depend upon its extent. *Lichen ruber planus* is more usually observed in the mouth and fauces than in the larynx. *Impetigo herpetiformis, erythema nodosum*, and *erythema multiforma* are rarely observed in the larynx.

Pathology.—Symptomatic laryngitis is ascribed to the penetration into the laryngeal tissues of micro-organisms, especially the streptococcus pyogenes, staphylococci, the pneumococcus, and bacteria coli communæ. The germs are thought to penetrate the deeper structures through minute abrasions of the surface or by way of the lymph-channels, the blood, etc. Neighboring inflammatory foci are especially prone to cause infectious disorders of the larynx.

Four cases of so-called angina Ludovici examined: (1) acute cellulitis of the neck following tonsillitis in which the streptococcus was present; (2) gingivitis due to dental caries in which the staphylococcus albus and aureus were found; (3) œdema glottidis and pneumonia in which the pneumococcus (Fraenkel) was found; and (4) phlegmonous inflammation in a pregnant woman who aborted and died of septicæmia; streptococci were found in the spleen and in the tissues of the neck. Although bacteriologically distinct, yet the processes were pathologically identical. Kanthack (Brit. Med. Jour., May 18, '94).

The various forms of acute septic inflammations of the throat hitherto described as acute œdema of the larynx, œdematous laryngitis, erysipelas of the pharynx and larynx, phlegmon of the pharynx and larynx, and angina Ludovici are probably identical pathologically, and represent degrees varying in virulence of one and the same process. Felix Semon (Jour. of Laryn., Sept., '95).

Erysipelas of the larynx, phlegmonous pharyngitis, and angina Ludovici are so similar that the slight difference in their starting-point is not a sufficient reason for making a different classification necessary. De Havilland Hall (Jour. of Laryn., Sept., '95).

Much good would result from this simple modification in the classification of these diseases suggested by Semon; personal experience tends in the same direction. Typical angina Ludovici the least likely to be pathologically identical with the rest. Dundas Grant (Jour. of Laryn., Sept., '95).

Treatment.—The treatment of symptomatic laryngitis does not differ from that of acute laryngitis or œdema of the larynx when the local manifestations are such as to warrant assimilation with these disorders. As a rule, the laryngeal manifestations of infectious diseases are slight, but the possibility of complications in this direction should always be borne in mind, owing to the rapidity with which they may prove fatal when untreated.

Chronic Laryngitis.

Symptoms.—As a result of frequently repeated attacks of acute laryngitis, or of continued exposure of the larynx to conditions capable of maintaining a prolonged hyperæmia of the larynx, a chronic catarrhal process is developed. Exacerbations of hoarseness, a sensation of rawness and heat, and the presence in the laryngeal cavity of secretions—mucoid or muco-purulent—giving rise to a constant desire to "hem" constitute the main symptoms of this condition.

Chronic laryngitis is most frequently met with in singers. Hoarseness in these represents the most important symptom; it may be continuous or occur only after a few bars have been sung. This is

usually accompanied by a feeling of local fatigue, heat, and constriction. The voice is usually lowered in pitch and may be veiled, muffled, or complete aphonia may exist. Pain is sometimes complained of. Cough provoked by sensation of itching or pricking frequently occurs as a prominent symptom. Slight hæmorrhage and blood-expectoration are occasionally noted.

In some cases these symptoms present themselves upon the least exposure, disappearing after a few days. As the attacks are repeated, however, they become more resistant to therapeutic measures, and the local disorder becomes permanent symptomatically as well as pathologically. Hoarseness is then continuous. Warm weather, however, is apt to bring temporary relief.

The laryngoscopical appearances vary considerably, and are proportionate to the degree of active inflammation. The evidences of local hyperæmia are nevertheless always present, and vary from a slight arborescent and light pink tinge suggestive of congestion to a bright-red hue indicative of violent inflammation. The epiglottis is also congested, enlarged vessels coming over its posterior surface, while the aryteno-epiglottic folds appear thickened, the tumefaction involving the entire larynx in marked cases. The surface is irregular and sometimes quite bosselated. The general redness is not so marked as in some cases of acute laryngitis; it is apt to assume a brownish or violet coloration. The vocal bands are also more or less congested; the congestion may either be limited to a small portion of their surface or involve their entire area. Small masses of stringy cream-like mucous are frequently to be seen forming films when the glottis is opened.

Sometimes the vocal bands appear relaxed and their thickened edges do not seem to come accurately together, an elliptical opening being occasionally observed between them. This want of parallelism is due to muscular paresis, affecting usually but one side.

Shallow abrasions of the epithelial covering are occasionally met with, especially in the interarytenoid space. Deeper ulcerations sometimes leading to perichondritis have been observed by various clinicians.

The secretions are sometimes very copious, especially when, in the latter part of an active exacerbation of vocal disability, the patient tries to use his voice. This condition is termed *"laryngorrhœa"* by some authors.

The terms *"dry laryngitis"* and *"laryngeal ozæna"* have been given to a condition occasionally met with, in which the secretion, besides being muco-purulent, is prone to adhere firmly to the mucous surfaces and to become partly desiccated in this situation. The dry crusts formed, by impeding the free passage of air, give rise to more or less dyspnœa, while the breath is rendered fœtid. Laryngoscopically examined, the larynx appears red and dry, with greenish crusts closely adhering to parts adjoining the vocal cords either above or below.

> Case in which the green secretion almost occluded the tracheal lumen, causing marked stridor. Kuh (Jour. Amer. Med. Assoc., Apr. 15, '93).

Etiology.—In singers, officers, hucksters, etc., who are called upon to use the voice excessively, chronic laryngitis may occur as a primary affection, but in persons who do not use their vocal organs professionally, the primary cause can usually be traced to some disorder of the adjoining cavities, nasal, naso-pharyngeal, and pharyngeal. A dusty or smoky atmosphere may induce chronic laryngitis, but the other portions of the upper

respiratory tract are involved in the inflammatory process.

The rheumatic and gouty diathesis, gastric and hepatic disorders, the abuse of alcoholic beverages, and all the factors enumerated under the heading of ACUTE CATARRHAL LARYNGITIS may act as causative factors when exposure to them is prolonged.

Dry laryngitis has been ascribed to many affections. In some cases it is but a manifestation of a general atrophic process involving the mucous membrane of the upper respiratory tract and may thus be identified through the presence of Löwenberg's bacillus.

> Existence denied of true pharyngitis and laryngitis sicca. In all cases seen it was combined with diseases of the Highmore antrum, with tubercular or syphilitic diseases. Krebs (Monats. f. Ohrenh., Nos. 6, 7, '95).
>
> Dry laryngitis may be primitive and occur independently of any lesion of the nasal pharynx. It is probably of a parasitic nature and caused by Löwenberg's coccus. Moliné (Jour. of Laryn., Dec., '95).

In the very few cases that I have met with, dry laryngitis, when not accounted for by a naso-pharyngeal affection or syphilis, was found associated with a gouty diathesis. The infraglottic space seems to be the favored region for the formation of the greenish crusts observed in this condition.

> "Laryngitis hiemalis," or winter laryngitis, a variety of subacute laryngitis in which the secretions are rapidly changed into adhesive crusts. Cold weather is the important factor in its production. There is complete aphonia. The crusts often cling to the surfaces of the true bands and the arytenoids. The evidences of inflammation in the larynx are slight. The condition differs from laryngitis sicca, which it closely resembles, however. Improvement rapidly follows removal of the crusts and the use of a spray containing vaselin and eucalyptol. Mulhall (Med. Review, June 17, '93).

Chronic inflammatory disorders of the larynx are more frequently observed in men than in women, doubtless because the former are more exposed to the etiological factors outlined than the latter. Smoking and drinking is a prolific indirect cause, as stated, and these habits are most generally indulged in by the male sex. Chronic laryngitis can occur at all ages.

> Case of chronic self-inflicted ulceration of the throat by means of nitrate of silver or nitric acid. F. Semon (Med. Press and Circ., Jan. 30, '94).

Pathology.—Dilatation of the blood-vessels, through paresis of the vaso-motors, interstitial infiltration which may lead to hypertrophy and thickening, are the main pathological features attending a case of uncomplicated chronic pharyngitis. The superficial vessels tend to become varicose, tortuous veins being observed, especially in regions—such as the ventricular bands, the interarytenoid membrane, etc.—where the tissues are lax. The glandular elements take an unusually active part in the inflammatory process of some cases, constituting what has been termed a "glandular laryngitis." Rounded sessile projections, differing but slightly from the neighboring tissues in color, have been called "chorditis tuberosa" or "trachoma of the larynx," but these are probably but mere localized hypertrophies, strictly associated with chronic laryngitis. The tissues beneath the vocal bands often take part in the inflammatory process.

Treatment.—The association so frequently noticed between chronic inflammation of the naso-pharynx and of the larynx renders it imperative always to examine the entire upper respiratory tract when continued hoarseness is complained of. This is further supported by

the fact that cases are often met with in which no benefit whatever is derived from treatment limited to the larynx until attention is given to the naso-pharyngeal surfaces. Cleanliness of these parts, in fact, may be considered a *sine quâ non* of success in 90 per cent. of cases. The same remarks may be applied in connection with concomitant disorders of other organs.

In many cases the laryngeal inflammatory process is sustained by disorders of gastric, hepatic, and renal systems, all of which require close scrutiny.

Attacks of hoarseness in professional vocalists are often but exacerbations of chronic laryngitis, a deficiency of lubrication of the vocal bands being the main local factor. This condition may successfully be combated by administration every two hours of 10 grains of ammonium chloride in a tumblerful of water, and the topical use of warm sprays of a saturated solution of potassium chloride at the same intervals. The doses are so managed that the last one should be taken at least about three hours before a performance. This avoids exposure during the subsequent stage of perspiration. A lozenge containing 10 grains of the ammonium chloride taken between the acts is of benefit in many instances.

The characteristic congestion of this affection, and even the superficial erosions frequently encountered, will often yield to a detergent spray of bicarbonate of sodium, borate of sodium, and salicylate of sodium, 3 grains of each to the ounce of water, applied copiously three times a day to the entire upper respiratory tract—the nose, the pharynx, and the larynx.

In stubborn cases occurring in singers, spraying with a 2-per-cent. solution of lactic acid, used frequently,—eight to ten times daily,—recommended. Hygienic measures and tonics form important adjuvants. Massei (La Sem. Méd., No. 32, '94).

After cleansing, even the slight erosions should be touched with stronger agents. Solutions of nitrate of silver are most effective, but demand considerable dexterity if laryngeal spasm is to be avoided. The laryngeal forceps must be used, its tip, covered with a cotton pledget, being gently applied to the mucous membrane. Resorcin is an effective agent in a solution containing 7 grains to the ounce. A 20-grain solution of iodoform in benzoinol is a very effective remedy, but the difficulty of keeping the atomizer free when benzoinol is used renders its employment obnoxious to the patient. The infraglottic region should not be overlooked when local applications are made, the patient being also directed to inhale deeply when the atomizer is being used.

Iodol might be substituted, but it possesses irritating properties when used in strong solutions: 5 grains to the ounce is the maximum strength that an inflamed larynx can stand with benefit. Solutions of sulphate of zinc, sulphate of copper, and alum, 5 grains to the ounce, may be substituted should the other agents recommended not be obtainable.

Mild cases, especially those in which there exists involvement of the infraglottic tissues, are greatly benefited by benzoate of sodium. Exacerbations are sometimes quickly stopped with 5-grain doses administered every three hours, in addition to the local measures recommended.

In certain cases the vocal bands will present, during an exacerbation of the catarrhal process, the greatest amount of congestion as compared with other parts of the laryngeal cavity. Their

mucous membrane, as stated, appears thickened, bosselated, and very red at the edge, the voice being coarse and screechy when an effort to sing is made. This form of chronic laryngitis is characterized by frequent exacerbations, and finally costs a singer his voice unless he stops singing for a while and undergoes active local treatment. Labus, of Milan, proposed flaying of the vocal bands in these cases, and obtained several satisfactory results. After thoroughly anæsthetizing the larynx he tore off with a sharp square-tipped laryngeal forceps the superficial layer of membrane of the vocal bands—a procedure followed by slight hæmorrhage, a few days' aphonia, and final recovery of the voice. I have substituted applications of chromic acid to destroy the thickened mucous layer, obtaining equally satisfactory results. Cocaine causing a copious flow of lubricating fluid from the lateral tissues when applied to the larynx for a certain length of time, it is necessary to use the acid as soon as possible after the application of the 25-per-cent. solution, the strength it is advisable to employ.

The chromic acid, fused by heat to the end of a covered probe, such as MacCoy's, immediately before the anæsthetic, is then applied to the surface of one of the vocal bands, while the patient, having been told to make a sound, brings both bands into apposition. This enables the operator to avoid cauterization of their edges—an important point in the preservation of the voice, especially in women. But little if any disturbance follows, and after a few days hardly a trace remains of the cauterization, except a spot presenting less redness than the surrounding parts. The applications should be made twice a week until all traces of localized congestion or bosselated areas have disappeared.

When laryngitis is aggravated by gastric, hepatic, or intestinal disorder, especially in drinkers and smokers, attention to these conditions should, of course, form an important part of the treatment. In patients who smoke considerably the congestion is often maintained simply by the irritating action of the air contaminated with smoke. Sitting in a smoking-car or in a room in which others are smoking is, therefore, as bad as if the patient himself were smoking.

In dry laryngitis, attention to the naso-pharyngeal disorder also forms an important part of the treatment. Detergent and disinfecting sprays are of great use, but must be employed for a considerable time. Chlorate of potassium in the form of a saturated solution, and permanganate of potassium, 3 grains to the ounce, are effective agents, while listerin and water, equal parts, may also be recommended, to alternate with either. Iodide of potassium, administered internally, 5 grains three times a day in half a glassful of water, tends to increase the laryngeal secretions, as it does those of the nasal cavities, especially in persons who are sensitive to its physiological effects. When a gouty or rheumatic diathesis can be traced, colchicine or salicylate of sodium are indicated. (See Gout and Rheumatism.)

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LARYNGOTOMY, LARYNGECTOMY, ETC. See Stenosis of Air-passages.

LARYNX, FRACTURE OF. See Fractures.

LARYNX, SYPHILIS OF. See Syphilis.

LARYNX, TUBERCULOSIS OF. See Tuberculosis.

LARYNX, TUMORS OF. See TUMORS.

LEAD.—Lead (plumbum) is not official, as it is not employed in medicine. Lead combines with oxygen forming oxides, one of which (the yellow) is official (plumbi oxidum, U. S. P.), with the acids and with chlorine, iodine, bromine, etc., forming salts. Of these salts the acetate is the only one used internally to any extent, although the iodide is rarely used for alterative purposes. The acetate of lead (sugar of lead) occurs in efflorescent, colorless, shining transparent prisms, or flat crystals, having an acetous color and a sweet, metallic taste. It is soluble in $2\,{}^{1}/_{3}$ parts of cold, and in ${}^{1}/_{2}$ part of boiling water; in 21 parts of cold, and 1 part of boiling alcohol; in 3 parts of chloroform, and in 5 parts of glycerin.

Carbonate of lead (white lead, or ceruse) occurs in perfectly-white masses or powder. It is insoluble in water, but soluble in acetic acid and dilute nitric acid.

Iodide of lead occurs in a golden-yellow powder and is insoluble in cold water, but soluble in 200 parts of boiling water and in solution of the alkalies and of the iodide of potassium.

Nitrate of lead occurs in white crystals, and is soluble in 2 parts of water.

Oxide of lead (litharge) occurs in a yellow to yellow-red powder and is insoluble in water, but soluble in acetic and nitric acids.

The above salts and their preparations are the only ones official in the United States Pharmacopœia.

Preparations and Doses.—Plumbi acetatis, 1 to 5 grains.

Plumbi iodidum, ${}^{1}/_{4}$ to 2 grains.

Liquor plumbi subacetatis.

Ceratum plumbi subacetatis.

Liquor plumbi subacetatis dil.

Plumbi carbonas (used externally).

Unguentum plumbi carbonatis.

Unguentum plumbi iodidi.

Plumbi nitratis (used externally).

Plumbi oxidum (used externally).

Emplastrum plumbi.

Emplastrum resinæ.

Emplastrum saponis.

Unguentum diachylon.

Physiological Action.—Unless a concentrated solution be used, lead applied locally acts as an astringent by inducing contraction of the capillaries. Hence its beneficial actions in inflammation. Concentrated solutions are irritating, on the contrary, and may induce inflammation.

Taken internally in therapeutic doses, lead also acts as an astringent, and diminishes the secretions of the gastro-intestinal tract. Beyond these effects the manifestations are those of poisoning. The nitrate, the subacetate, and the acetate are poisonous in the order named.

Acute Lead Poisoning.—Acute poisoning is rare, but may occur when a soluble salt (notably the acetate) is taken in poisonous amounts (not less than 1 ounce is necessary to produce serious effects). The symptoms are a sweet, metallic taste in the mouth, pain in the epigastrium, and vomiting of white milky-looking liquids, or white curds, mixed with food if any food was present in the stomach. The white color indicates the presence of chloride of lead, formed by the action of the hydrochloric acid of the gastric juice. Later, irritation of the intestinal tract occurs with an increase of pain, and either diarrhœa due to gastro-enteritis or, in some cases, obstinate constipation is noticed. The stools are generally black in color (from the action of the intestinal sulphuretted hydrogen-gas, which forms a sulphide). The pulse becomes rapid and tense, but later weak and compressible. The face is anxious

and may be either pale or lived. Excessive thirst is present, with cramps in the calves of the legs or muscular twitchings. In fatal cases coma, epileptic spasms, or collapse ensues. Up to the point of the affection of the nerve-centres (spasm, coma, or collapse) the prognosis is good; beyond this it is unfavorable.

Treatment of Acute Poisoning by Lead. —If there is reason to believe that any of the lead-salt is present in the stomach, the stomach-siphon may be used. Any soluble sulphate (Epsom or Glauber's salts) will decompose the lead salt and form an insoluble sulphate of lead; if used in excess the salts mentioned will act as purges and wash out the offending matter. Cramp and spasms may be relieved by hot applications to the abdomen and to the extremities. Pain may be relieved by opiates.

Chronic Lead Poisoning.—The sources of poisoning by lead are very numerous. Occupations in which lead is employed, however, predominate as causative factors, and painters, white-lead-paint mixers or grinders, wall and other paper-mill operators, glaziers, etc., are the victims in the great majority of cases.

Adulterated foods and liquids represent the main sources of poisoning among those whose occupations do not involve exposure. Cooking utensils painted white inside, bread made of flour contaminated with a lead-filled grind-stone, cake colored with lead bichromate to avoid the use of eggs, imperfectly burnt pottery, fruit-jars glazed with lead, etc., are as many media through which lead can reach the system. A fruitful cause of poisoning is pure water when conveyed through lead pipes, the lead being slowly dissolved. When, however, the water contains even a minute quantity of lime-salts, an insoluble coating is formed which arrests all further action as soon as the inside of the pipes is completely covered. Cosmetics, hair-dyes, and face-powders occasionally cause plumbism.

Constitutional Effects. — Slow absorption of lead, whether due to industrial, accidental, or criminal causes, mainly affects the muscles, the peripheral nerves, the liver, and the kidneys. Pallor of muscles and mucous membranes is an early result, fibrosis occurring in advanced cases, accompanied by degenerative changes in the nerve-endings. These changes become less marked as the spinal centres are approached, the spinal cord being usually normal. The brain, however, is not so exempt from morbid changes. All the manifestations of saturnine toxæmia are pathologically based upon the changes here outlined.

A blue line along the margin of the gums, at the base of the teeth, is an important sign. It is especially marked in persons who are not cleanly as regards their mouth.

Lead Colic. — This symptom is most frequently met with in painters who mix and use white lead. The abdominal cramp is usually very severe, the muscles being rigid and contracted. A peculiarity of the pain is the fact that the location of its greatest intensity is around the navel. It occurs by exacerbations, the accesses being often accompanied by nausea or vomiting. The tongue is white and contracted and there is thirst — sometimes intense. Constipation is the rule. The face is pale or jaundiced.

After continuing for a period varying from a few hours to several days, the symptoms gradually recede and the access ceases. When no treatment is resorted to and the causative occupation is continued, the attacks return frequently, and death may finally occur through cachexia or anæmia, paralysis of the re-

spiratory muscles, cirrhosis of the liver, or through some intercurrent disorder.

Lead Encephalopathy.—In some cases marked cerebral symptoms occur. These may develop gradually or quite suddenly, violent headache, vertigo, tinnitus, strabismus, and other cerebral manifestations presenting themselves. In the cases developing slowly the symptoms tend to demonstrate paresis of carious systems, central and peripheral, the most characteristic of these being wrist-drop, due to paralysis of the extensor muscles of the forearm. Vertigo, loss of memory, disturbances of the special senses, cerebral palsies, hemiplegia, and monoplegia have also been noted. Alteration of the brain-structure, its arteries and meninges, is usually found post-mortem.

Convulsions, amaurosis, delirium, and coma, or a condition simulating epileptic fits, hallucinations, mania, melancholia and hysteria are not infrequently met with. Saturnine epilepsy is a dangerous manifestation and usually ends in death.

General Disorders due to Lead.—Lead may act as an etiological factor in many diseases. Its rôle as such is fully considered in the articles upon the various affections, and do not require repetition here.

Treatment of Chronic Poisoning.—The indications are to remove the causes, to remove the poison already in the body, and to treat the lesions or tissue-changes produced by the poison. Frequent doses of Epsom salts will not only relieve the colic, but will convert any lead present in the gastro-intestinal tract into an insoluble sulphate, and expel it from the body. Jalap and calomel, guarded with opium to prevent griping, and alum in 2-grain doses with opium or morphine, are suggested as valuable remedies. When cerebritis is present a blister may be applied to the nape of the neck, and revulsions, amyl-nitrite, and sweating (by pilocarpine) may be tried. To eliminate the lead our sheet-anchor is the iodide of potassium, given in doses of 10 to 20 grains three times daily. A double soluble salt (potassic iodide of lead) is formed, which may be excreted by the kidneys through the urine and by the liver through the bile. Paralysis is an indication for the exhibition of strychnine in large doses, during treatment with potassium iodide (given separately), and the employment of massage and electricity. The induced (faradic) current should be employed if the muscles react: if they do not, galvanic current is indicated. When no reaction to the direct (constant or galvanic) current is observed, the paralysis is seldom recovered from. In all cases removal from the source of poisoning should be insisted upon.

Therapeutics.—Lead is never given to affect the system at large: the constitutional effects are of no use in medicine. It is used only for the local effects,—astringency, etc.,—which differ with the form used.

Gastro-Intestinal Disorders.—Acetate of lead is an astringent remedy often used to arrest hæmatemesis, especially when due to gastric ulcer. It is also recommended in chronic gastritis with pyrosis and gastralgia. In diarrhœa of phthisis, choleraic diarrhœa, and in summer diarrhœa a few grains of the acetate with a small dose of opium or morphine relieves speedily. In acute and chronic dysentery an enema of 4 grains of the acetate, $^1/_2$ grain of morphine acetate, and 1 ounce of warm water will relieve the tenesmus and reduce the frequency of the stools.

In cholera and the purging from dysentery and typhoid fever a few grains of the acetate may be combined with starch

and a moderate dose of opium, and be given in enema. The acetate may also be combined with opium in suppository for checking various forms of diarrhœa and for the relief of irritable conditions of the rectum.

External Applications of Lead.—An excellent application to burns is white-lead paint (carbonate of lead and linseed-oil), especially if the surface is not very large and there are no fears of a dangerous amount of absorption. The official ointment of the carbonate of lead may be preferred.

Lead lotion (liquor plumbi subacetatis), diluted with 3 or 4 parts of water, is a good application to eczema, where there is much weeping. It is also valuable when combined with laudanum (lead-water, 4 parts; laudanum, 1 part; water, 16 parts) as an application to inflamed surfaces, bruises, sprains, fractures, blisters, scalds, excoriations, and fissured nipples.

The acetate of lead is also an excellent application for the dermatitis produced by poison-ivy (*Rhus toxicodendron*), as the lead precipitates the non-valuable oil of the poison. For this latter purpose Hare advises that 8 grains of lead acetate should be dissolved in a pint of alcohol and used as a wash; cooling applications should follow, but ointments should be avoided, as they dissolve the poisonous oil and spread the irritation.

Lead acetate is a useful application. In pruritus pudendi the lead-water, or cerate, may be used. Helva recommends the application of equal parts of lead plaster and linseed-oil for sweating feet. They should be applied on linen and wrapped around the feet every third day. Nitrate of lead is used, in powder, in the treatment of onychia.

In gonorrhœa and leucorrhœa a solution of lead acetate (3 or 4 grains to the ounce of water) may be used as an injection. Lead preparations should never be used in eye-lotions, as they are apt to deposit the lead in the tissues of the cornea and leave permanent white patches, especially if ulcer of the cornea is present.

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LENS, DISEASES OF.

Anomalies of Position.—Anomalies of position are always the result of changes in the zonula of Zinn.

Classification.—Cases of dislocation of the lens are commonly divided into two groups: in one of which the lens has completely left the fossa patellaris (luxation, or complete dislocation), while in the other it still remains partly within this cavity (subluxation, or partial dislocation); but as it is usually only a matter of time for cases in the latter group to find their way into the former, this distinction only marks a stage in the history of the case.

A more convenient and comprehensive classification can be made on an etiological basis.

Dislocations of the lens are either *congenital* (ectopia lentis) or *acquired*.

The latter group may be thus divided:—

1. Traumatic cases, in which the lesion varies in degree: (*a*) There may be a partial displacement, the lens being caused to rotate on its axis, or pushed sideways, thus assuming an oblique position, or a position with its edge in the pupil; or it may be displaced sideways *and* rotated. (*b*) It may be completely dislocated into the anterior chamber. (*c*) It may be completely dislocated into the vitreous chamber. (*d*) It may pass through a rent in the sclerotic, and lie under the unbroken conjunctiva: sub-

conjunctival dislocation. (*e*) It may pass through a rent in the conjunctiva. (*f*) It has been found beneath Tenon's capsule.

2. The lens may escape from the eye at the moment of rupture of the floor of a large corneal ulcer: a more common incident in the cases of ophthalmia neonatorum than in any other form of disease.

3. It may be dragged out of position by iridic adhesions when the iris is stretched or rendered tense by the occurrence of peripheral staphyloma.

4. It may be pushed out of position by intra-ocular tumors.

5. Its displacement may be spontaneous.

Ectopia lentis seems to depend upon imperfect or incomplete development of the zonula, and, as this developmental failure occurs especially along the line where closure of the ocular fissure takes place, the more perfectly developed fibres at the upper part drag the lens in their direction. Consequently congenital displacements are almost always directly or obliquely upward. They are also usually symmetrical, and are not infrequently accompanied by coloboma of the lens, which, moreover, is apt to be undersized and thicker than normal.

In accordance with the above theory, dislocation of the lens is occasionally associated with coloboma of the iris, ciliary body, and choroid.

Two cases of spontaneous dislocation of the lens. Although produced by different mechanism, the two accidents were due to a like cause,—a previous alteration of the zonula. Fage (Jour. de Méd. de Bourdeaux, Feb. 16, '90).

Case of double congenital dislocation of the lens in a boy 7 years of age, who was also partially amblyopic. The lens in each eye was tilted upward, slightly backward, and inward. No other structural changes could be detected. Conclusions that: (1) congenital ectopia lentis is usually double: (2) it is a congenital malformation, the cause of which is not yet positively established; (3) amblyopia and ametropia are always concomitant conditions, and that the majority of cases, so far reported, sustain the theory of heredity as the primary cause. Friebis (Jour. Amer. Med. Assoc., Sept. 3, '92).

Literature of '96-'97-'98.

Series of lenses, 8 in number, in which the nucleus was not central, but lay close to the posterior capsule, either at the posterior pole or between it and the equator. In all the anomaly must have been due to a developmental disturbance. In some the outline of the lens was normal; in 5 others there was a posterior lenticonus. In 3 of these latter the conical ectasia of the lens-surface was formed by the displaced lens-nucleus, which was actually in contact with the capsule; in the other 2 this was not the case, the lens-fibres lying quite regularly on the little cone. The anterior section of the lens was in all cases normal. Only in 1 case did the lens-capsule, much thinned, cover the lenticonus. C. Hess ("Bericht der Ophthal. Gesell.," Heidelberg, '96).

Dislocation of the lenses observed in five children of a family of seven whose mother was similarly affected. In none of the cases was the dislocation upward. Miles (Annals of Ophth., Otol., and Lar., July, '96).

Five cases of congenital bilateral dislocation of the crystalline lens in three successive generations. In all the dislocation was upward or upward and outward. E. T. Parker (Phila. Med. Jour., July 16, '98).

A case is on record in which the coloboma of the iris was upward, there being a subluxation of the lens downward.

Although at first partial, congenital dislocation often becomes complete, through degeneration and stretching of the fibres of the zonula; the lens then becomes movable to a degree which varies greatly, not only in the vitreous humor itself, but it may even pass backward and forward through the pupil: a

condition described by Heyman under the title of "spontaneous motility of the lens."

So long as a congenital dislocation of the lens remains incomplete, there is no special tendency toward the formation of cataract; but when it becomes complete, and freely movable in the eye, the impairment of nutrition thereby involved leads more or less rapidly to its opacification. Occasionally a lens dislocated into the vitreous will remain clear for years.

Of all cases of dislocation of the lens, those of traumatic origin are, by far, the commonest. The traumatism usually consists of a blow by a blunt instrument, such as the fist or a stone, upon the eyeball; but concussion from a blow upon the side of the head may have the same result. Dislocation is more apt to occur when the vitreous is fluid: a condition which may be accompanied by degenerative changes in the zonula, in old age, and in sclerectasia anterior.

> Traumatic luxation of the lens into the anterior chamber usually occurs when the patient is bent forward, the centre of the cornea being struck at that time. When the blow is nearer the periphery the luxation takes place in the direction of the force applied. Dujardin (Jour. des Sciences Méd. de Lille, Nov. 13, '91).

Traumatic dislocations present every variety and degree, from the slightest lateral displacement or rotation to complete expulsion of the lens from the eyeball.

> Lens in an eye removed on account of a penetrating wound found to be dislocated between the ocular conjunctiva and the sclera, where it had become incapsulated in a mass of inflammatory exudate. Wescott (Annals of Ophthal. and Otol., Jan., '93).

> Two instances of traumatic dislocation of the lens into the vitreous, occurring in individuals both of whom had met with a similar accident in the opposite eye some years previously. Noyes (N. Y. Eye and Ear Infirmary Reports, '94).

The traumatism that is the immediate occasion of the displacement is often the cause of other ocular lesions, which may, for a time, obscure the diagnosis, and render prognosis more uncertain than would otherwise be the case. The dislocation of the lens may, indeed, be by no means the most important lesion produced. It is common to find hæmorrhage in the anterior chamber immediately after the injury, the full extent of which cannot be ascertained until absorption has taken place: or we may find dilatation and immobility of the pupil, hæmorrhage into the vitreous, or rupture of the choroid, and—especially in myopic eyes—detachment of the retina. In greater degree of violence the eyeball may be ruptured, usually in the sclera just behind and concentrically with the sclero-corneal junction, and through this rupture the lens—with the iris, choroid, retina, and vitreous—may escape.

> Case of traumatic dislocation of the lens, followed by symptoms of fulminating glaucoma. Patient made a good recovery after extraction of the lens. Saunders (Brit. Med. Jour., Mar. 2, '89).

> Absorption of a crystalline lens that had been luxated into the vitreous during an operation upon the eye for glaucoma. Case occurred in a boy. All children have remarkable tolerance for that which would cause glaucoma in adult eyes. Chacon (Gaceta Méd. de Mexico, June 1, '92).

Spontaneous dislocation of the lens may take place while its transparency remains unimpaired, but it seems to occur more commonly when the lens has become cataractous, and more especially when the cataract has been allowed to progress to a condition of hypermaturity (Morganian cataract). Although in some cases the displacement occurs without any evident immediate exciting cause, in

many the acts of coughing or sneezing determine it. Gunn in 1895 reported a case of quite spontaneous symmetrical displacement of the lenses in a man aged 76. Three months before it failed a recorded examination showed vision, with refraction corrected, to be $^6/_6$ in each eye. Three months after failure both lenses were found displaced downward, their upper edges being visible just within the margin of the dilated pupil, one lens still remaining clear, the other having become opaque. Corrected vision in each eye, $^6/_6$. Fundus normal. It is hardly necessary to point out that old age constitutes the main predisposition to spontaneous dislocation of the lens, the immediate pathological factor being an atrophy of the fibres of the suspensory ligament: a condition described by Wedl and Bock as "senescence of the zonula."

Symptoms; Appearances; Vision. — Any change in the position of the lens destroys the normal relations between it and the iris, the latter losing its support partially or totally, according to the degree of the displacement, or being unduly pressed forward or backward, or distended, according as the lens is tilted against portions of the posterior surface of the iris, dislocated into the anterior chamber, or fixed in the pupil itself. When the dislocation is incomplete the anterior chamber is deeper at the point vacated by the lens, and the iris of the same region is tremulous on quick movements of the eyes or head. In the slightest degrees of dislocation a slight tremulousness of one portion of the iris may constitute the only physical sign of the lesion, but is an absolute indication that the iris no longer rests on the anterior capsule of the lens. The history of injury and the condition of vision will be necessary to lead to a correct diagnosis.

Increased depth of one portion of the anterior chamber may be accompanied by increased shallowness of another, from tilting forward of some portion of the lens against the iris and ciliary body: a relation which may result in setting up a condition of glaucomatous tension and form a very important factor in the progress of the case.

By employing focal illumination the edge of the lens can be seen in the pupil, which, however, usually requires to be dilated for this purpose. The lens itself will appear as a delicate gray compared with the pure black of the aphakic portion of the pupil, and its edge will appear luminous on account of the total reflection which the rays of light entering the marginal portions of the lens from the front undergo at its posterior surface; for at the edge of the lens they strike this posterior surface very obliquely.

With the ophthalmoscope, on the other hand, the edge of the lens appears black, for the same reason, the light coming into this portion of the lens from the fundus being reflected back into the eye.

When there is complete dislocation of the lens there will be an absence of the catoptric lenticular images. The lens itself when opaque may be visible through the pupil with the naked eye. As a rule, however, examination with the ophthalmoscope is necessary for its detection. It may be connected with the fundus or freely movable in the fluid vitreous (cataracta natans).

There is now more marked and general tremulousness of the whole area of the iris on quick movements of the eyes and head, with an abnormally, but uniformly, deep anterior chamber.

When once seen there is no difficulty in determining the nature of the floating body, on account of its shape and size and the fact that no other condition

occurs with which it is possible to confound it.

When the lens is displaced into the anterior chamber its appearance is characteristic, its margin having a golden luster due to total reflection of light, making it look like a large drop of oil in the anterior chamber, which is much deepened, especially at its lower part. The lens assumes, moreover, a more spherical form than when *in situ*, on account of the loss of the compressing influence of the fibres of the suspensory ligament and choroid, etc. The irritation it sets up often causes a contraction of the pupil behind it.

> In case of old, traumatic, dislocated, cataractous lens the central half of the pupillary quarter of the iris was altered in color and in brilliancy, while the ophthalmoscope revealed an alternate free transmission of the choroidal reflex and intercepting radial lines of iris-stroma. This latter points to a previously-existing radial muscular mechanism in the once healthy iris. Symon (Australasian Med. Gaz., July 15, '92).

Condition of Vision.—Sight is always impaired to a greater or less extent. In partial dislocation, vision is affected, because rupture of the fibres of the suspensory ligament destroys the power of accommodation, and, at the same time, by permitting increase in the convexity of the lens, makes the eye highly myopic. Moreover, the tilting of the lens on its axis induces a variable amount of astigmatism, regular and irregular, lateral displacement having a similar effect.

In higher degrees of displacement, where the edge of the lens lies across the area of the pupil, not only is there a higher degree of visual failure, but there is also diplopia, two blurred images being seen. This is due to the fact that the edge of the lens acts as a prism, and causes the rays of light entering the eye through it to be deviated in the direction of the dislocation, while those entering the aphakic portion of the pupil are unchanged in direction except in so far as they are made to converge and form an indistinct image on the retina.

> Case of double dislocation, one upward, the other downward, with atrophy of the zonula. There was so-called monocular triplopia from a double image formed by the displaced lens, joined to a third image made by the media without the lens. Heddaeus (Zehender's klin. Monats. f. Augenh., May, '88).

Considered, therefore, with regard to that portion of the pupil still occupied by the lens, the eye is myopic, and the image formed by the light-rays passing through it can be cleared to a greater or less extent by concave sphero-cylindrical lenses. With regard to that part from which the lens is absent, the eye is highly hypermetropic, and its image can be made clear by the aid of a convex spherical glass, and such a cylinder as is necessary to correct the corneal astigmatism. In a later stage vision may be further impaired by the development of opacities in the lens.

When the lens is completely dislocated into the vitreous chamber, and no complications have arisen, vision resembles that of an eye after cataract extraction, and the condition is exactly similar to that brought about by the operation of reclination, or couching.

The patient regains good vision with the aid of strong convex lenses, which have to be adjusted for distance, and also for the near point at which it is desired to read or work.

But in many of these cases complications arise which prevent perfect vision from being attained, or in course of time bring about its impairment in varying degree. Thus, iridocyclitis may arise and destroy vision and even set up sympathetic disease in the fellow-eye. Or glau-

comatous tension may occur, with the same result, so far as sight is concerned.

Four cases of spontaneous luxation of the lens, two of which were congenital. In one the luxation was bilateral. In three instances the lens had to be extracted, after years of quiet, upon account of violent glaucomatous attacks. Armaignac (Jour. de Méd. de Bordeaux, June 23, '95).

Case of secondary glaucoma following partial dislocation of lens; removal of lens; cessation of all pressure-symptoms. Oliver (Wills Eye-Hosp. Reports, vol. i, p. I, '95).

Literature of '96-'97-'98.

Case in which a lens dislocated into the vitreous during a cataract-operation set up so much sympathetic disturbance six months later that enucleation was necessary. K. Hoor (Wien. med. Woch., Aug. 22, '96).

Progress and Results. — Congenital dislocations are always incomplete, and the lens shows no special tendency to become opaque: good evidence that its nutrition is unimpaired. In some cases, however, the displacement increases, and complete dislocation into the vitreous or anterior chamber, or alternately into each, finally occurs. The latter condition is predisposed to by abnormal smallness of the lens: a common characteristic in cases of ectopia, which permits its easy passage through the pupil. When this state of complete luxation has been attained, the lens-substance is liable to deteriorate and become opaque. Striking against portions of the uveal tract the freely-movable lens may set up iridocyclitis, and disorganization of the eye and destruction of vision result. Or, as previously stated, secondary glaucoma may become established and finally lead to blindness.

In two cases, father and daughter, seen in the practice of the writer, the father, aged 55, had opaque lenses freely floating in the vitreous, and sometimes passing through the pupil into the anterior chamber, with occasional glaucomatous attacks, always relieved by paracentesis. The daughter presented typical examples of ectopia lentis, both lenses being stationary and quite clear. Good vision was obtained with convex lenses.

Although there are cases in which a small lens may pass freely through the pupil, as a rule, a lens dislocated into the anterior chamber sets up violent inflammation. The irritation caused by its pressure on the anterior surface of the iris excites contraction of the pupil and iritis, which fix it firmly in position. Or a few white spots indicate the presence of adhesions between the lens and cornea, caused by inflammation of the latter. There is glaucomatous tension and rapid extinction of sight. As a result of the increased tension, ectasia of the anterior part of the sclerotic occurs, and a general enlargement of the eyeball.

Spasm of the sphincter iridis, just referred to, may occur while the lens is in the act of passing through the pupil. There then arise violent inflammatory glaucomatous symptoms.

In a case in which dislocation of the lens into the vitreous occurred as one of the results of the lodgment of a small piece of steel in the eye, the lens was found, after enucleation on account of persistent pain due to absolute glaucoma, to be completely opaque and *black*. The source of the pigment was quite evident, for the choroid was apparently entirely devoid of it. The foreign body was encysted in fibrous tissue attached to the retina near the equator. The enuclation was performed about twenty-five years after the injury, the eye having been blind for many years.

Treatment.—When no symptoms other than impairment of vision exist, suitable glasses may be prescribed; but when one eye only is the subject of dislocation, the other being normal and of good visual acuity, the patient will get on better without a correcting glass, depending on the good eye for clear vision. In cases of subluxation, the margin of the lens lying in the pupil, the kind of lens ordered depends upon whether better vision can be obtained by correcting the portion of the pupil containing the lens, the myopic area, or the aphakic, hypermetropic area. This can, of course, only be ascertained by actual experimentation.

Sometimes better vision can be obtained by enlarging the aphakic portion of the pupil by a small iridectomy. Other things being equal, this portion is to be preferred for correction on account of the greater size of the retinal images so obtained.

When the dislocation is complete, the lens being in the vitreous, the case is precisely similar from a refraction standpoint to one of aphakic after cataract extraction. Under all conditions two pairs of glasses are required: one for distance and another for reading or working distance.

But in many cases other symptoms besides disturbances of vision are present at an earlier or later stage in the case. In cases of partial dislocation pressure of the lens against the ciliary margins of the iris and the ciliary body may set up glaucomatous symptoms. In this case, if removal of the lens be not deemed feasible, an iridectomy may be made at the point where the lens is in contact with the iris.

Removal of the partially-dislocated lens is always difficult, and apt to be complicated with loss of vitreous, on account of the condition of the suspensory ligament, which is either congenitally deficient or damaged by traumatism.

> Great stress laid upon the importance of the immediate use of a mydriatic in injury of the lens. Millikin (Jour. Amer. Med. Assoc., Sept. 3. '92).
>
> In a case of secondary glaucoma from partial dislocation of the lens into the anterior chamber, removal of the lens was followed by immediate cessation of all pressure symptoms. In this case the lower half of a densely-cataractous lens had pushed its way through the pupillary opening and had pressed the iris in this position far back behind it. To effect its removal a peripheral incision was made in the lower outer third of the cornea. A wire loop was introduced and the lens was extracted without the loss of any vitreous, obtaining a clear and round pupil. Oliver (Wills Eye-Hosp. Reports, vol. i, p. 1, '95).

Literature of '96-'97-'98.

> Slight partial dislocation of the lens can be cured by the continued use of atropine, which gives the zonula a chance to repair, or by eserine if vision is improved by its instillation and where the tests show that atropine produces a still further tilting of the lens. Dunn (Va. Med. Semimonthly, Jan. 2, '97).

When the lens is dislocated into the anterior chamber, extraction is comparatively easy, and, moreover, absolutely necessary. If it is not done, vision is inevitably lost. The lens is fixed in the anterior chamber by the use of miotics or the introduction of Agnew's bident, and the ordinary corneal incision for cataract made. Delivery has to be accomplished by means of the vectis, wire loop, or sharp hook.

> Six cases of successful extraction of luxated lenses by the assistance of the Agnew bident. In the use of the instrument, the lens should not be pressed too far into the anterior chamber, as in performing the after-section for the extraction of the lens; the iris and the lens are thus rendered more liable to be cut

through, or the section itself may be forced to insufficient size. Pomeroy (New England Med. Mthly., May, '89).

Three completely luxated lenses successfully removed by the aid of an electric photophore, which was made to illuminate the interior of the eye. After the illumination had been effected a pointed hook was introduced through the sclera to fix the lens, which latter was held in position while an assistant lacerated the capsule with a cystitome that had been introduced into the anterior chamber. The resulting soft cataracts were removed, six or eight days after, by aspiration. Abadie (Recueil d'Ophtal., Aug., '92).

Traumatically dislocated lens successfully removed from anterior chamber of an eye presenting glaucomatous symptoms. After transfixing the lens with a stop-needle, extraction was accomplished by introducing a wire loop through a broad peripheral corneal incision; owing to an irreducible prolapse of the iris, an iridectomy had to be made. Healing was uninterrupted, and normal vision with a correcting glass was regained. Oliver (Annals of Ophthal. and Otol., July, '92).

Case of luxation of the lens into the vitreous which caused no symptoms for three years, and then from some unknown cause, the lens having passed into the anterior chamber, the eye became very painful. Massage, which, being done with the fingers on the closed lids, forced the cataractous lens back into the vitreous. To prevent recurrence, the pupil was kept small by miotics. Boggi (Ann. di Ottal., xxv, i, p. 77).

When the lens floating in the vitreous causes iridocyclitis or secondary glaucoma, its removal is indicated. To do this is a matter of great difficulty. If the case be one in which the lens sometimes passes into the anterior chamber, attempts should be made to bring about this change of position by such movements as have previously effected it. Once in the anterior chamber it should be fixed there by the use of a miotic or by the introduction of Agnew's bident behind it. If the lens cannot by voluntary movements be made to enter the anterior chamber, it may be brought to the anterior part of the eye by the bident and fixed there. It may then be removed by corneal incision, and its delivery usually requires the use of the vectis, or sharp hook. Some vitreous is usually lost, and this is most apt to occur during the removal of the bident, which seems to be the most dangerous part of the operation.

Luxated lens successfully removed from the posterior chamber of an eye by first performing a downward iridectomy, followed two months later by extraction with the aid of a curette, a small amount of vitreous being lost. In eighteen days vision equaled two-thirds of normal. Despagnet (Recueil d'Ophtal., June, '89).

In the extraction of dislocated lenses it is possible "in many cases, perhaps in the majority, to extract the lens by external pressure, and to confine the use of instruments to assist in the removal of the lens after it has presented in the wound, or, at least, in the field of the pupil." C. S. Bull (N. Y. Med. Jour., Sept. 6, '90).

Two cases of dislocation of the lens into the vitreous humor, in which extraction was successfully accomplished by first making an upper corneal section and then expelling the lens by methodical external pressure in the ordinary manner, the speculum having been removed during the latter part of the procedure. Knapp (Archives of Ophthal., Jan., '90).

Literature of '96-'97-'98.

Lens dislocated into the vitreous removed without iridectomy while the patient was lying prone on an operating-table. Higgins (Lancet, Dec. 26, '96).

Knapp and Bull maintain that such lenses can be removed, and have published reports of cases showing such to be the case, without the use of the bident, and without the introduction of any instrument into the eye, by means of external manipulation only.

When an eye is blind and the seat of absolute glaucoma or of iridocyclitis due to dislocated lens, the pain so caused is best relieved, and the danger of sympathetic affection of the other eye most effectually avoided by enucleation.

In a case of dislocation of both lenses into the vitreous, of congenital origin, reported by Bickerton in the Trans. Oph. Soc. U. K., '98, the lens of one eye passed into the anterior chamber, causing reduction of vision to the perception of light and shade. After sixteen days the lens was replaced in the vitreous by a spatula introduced through a corneal incision, with the restoration of perfect vision, the aphakic refraction being corrected.

Case of spontaneous dislocation of both crystalline lenses into the anterior chambers occurring in myopic eyes. The right eye, which was entirely blind and painful, was enucleated, while from the left anterior chamber a partially-degenerate lens was successfully removed. With the exception of an aggravated spasmodic entropion, necessitating operative interference, rapid healing took place, leaving a vision of $^{10}/_{100}$, without the necessity of any correcting lens. De Schweinitz (Univ. Med. Mag., Nov., '89).

Congenital Anomalies.

1. Ectopia Lentis. See Anomalies of Position.

2. Coloboma lentis is a rare condition due to arrest of development at a late period of embryonic growth. The frequent association of coloboma of the iris and choroid with it suggests its relation to imperfect closure of the fœtal cleft. Its immediate cause lies in defective development of the zonula of Zinn. This is developed from adhesions, which form between the sides of the lens and ciliary body during the stage of embryonic life when they are in contact. As the eye enlarges, that portion of the capsule to which adhesions have failed to occur would not be held taut and made to expand like the remainder, and a corresponding depression in the lens would result. Absence of the ciliary body would, of course, be a probable cause of this failure to adhere.

Two cases of coloboma of lens in a brother and sister 8 and 11 years old, respectively. The condition is best explained as the result of an alteration, inflammation, or absence of formation of a portion of the zonula, which would permit but a part of the lens to come in immediate contact with the sclera, and that the adhesion thus produced would be the starting-point and cause of the displacement of the lens. Sous (Jour. de Méd. de Bordeaux, Oct. 13, '95).

Literature of '96-'97-'98.

Instance of congenital coloboma of the lens in the left eye of a man 20 years of age. The lens could be seen to exist only for about the upper half of the pupillary space. Extending from the inferior border of the lens-substance to and behind the inferior border of the pupillary margin there was a delicate membrane showing fine, vertical parallel striæ. The inferior border of the lens appeared terraced and transparent, but above this it became opaque. The diameter of the cornea was from one to two millimetres less than that of the right eye. The iris was dull dirt yellow, that of the fellow-eye being brown. In two places the pupillary membrane could be seen. Dunn (Archives of Ophthal., July, '96).

Heyl has suggested that a defect in the inferior branches of the hyaloid artery, which gives nutrition to the lens while the peripheral fibres are developing, would produce just such a defect.

It is often associated with coloboma of the iris and choroid, and with dislocation and small size of the lens. There is sometimes more or less opacity of the lens.

Literature of '96-'97-'98.

Two cases of coloboma of the lens. In one it was the sole anomaly present; in

the other it was associated with partial coloboma of the iris and choroid. Rogman (Archives d'Ophtal., May, '96).

Tremulousness of the iris has been observed, but more especially in cases in which ectopia also has been present.

The defect usually occurs in the inferior quadrant, but has been seen upward, outward, and down and out.

Literature of '96-'97-'98.

Case of coloboma of lens in a young man, whose father and one brother presented the same condition. O. D. V = 1/20, O. S. V = 1/25, increased in O. D. by the almost complete closure of the eyes when the patient looked at near objects. The lenses were displaced upward and inward, and were transparent, presenting neither coloboma (?) nor atrophy. The ophthalmoscope showed the lens a refraction of + 20 D. and through the aphakic media of — 8 D. The papilla presented a physiological excavation and posterior staphyloma. Hassler (Lyon Méd., Feb. 9, '96).

It resembles in form the chord of an arc, nearly a straight line, but sometimes consists of a complete notch.

It may occur in one eye or in both, and is most commonly associated with myopia. Vision is almost always defective, ranging from absolute blindness up to V = 1/4, as a rule. But Bresgin recorded a case in 1874 with V = 20/20 and fair accommodation.

Accommodation seems to be usually present in those cases in which vision is good enough to permit of reliable observation of this point. Nystagmus is sometimes present.

A case has been observed in which a projection from the lens-margin was associated with a coloboma of the iris.

3. Congenital Smallness of the Lens.—In these cases the anterior chamber is deeper than normal, and the iris tremulous. The condition can be recognized only after dilatation of the pupil with a mydriatic. An unusually wide space is then seen between the pupillary edge of the iris and the margin of the lens, which stands out as a dark ring against the fundus. Unusual smallness of the lens often accompanies ectopia and coloboma lentis.

4. Aphakia.—Cases of this condition in microphthalmic eyes have been reported, but Lang expresses the opinion that in many the absence of the lens is apparent only, it being really only displaced out of sight.

5. Lenticonus.—This may occur at either the anterior or posterior pole of the lens, the latter being by far the commoner situation. Only two instances of the former are on record, and there is doubt whether they were congenital or acquired. The condition resembles keratoconus. Anterior lenticonus can easily be recognized by oblique illumination.

Posterior lenticonus requires the ophthalmoscopic mirror for its diagnosis. It gives the appearance of a large oil-drop in the pupil, with a dark, well-defined border. Opacities of the posterior pole of the lens are often associated with it. The refraction is found to be different through the central and peripheral portions of the lens. In one case a remnant of the hyaloid artery was adherent to it.

Reference may perhaps be made here appropriately to the somewhat common cases in which the refraction is found, by estimation with the ophthalmoscope or skiascope, to vary in different parts without any other indication of lenticonus. Sometimes decided differences are found in the upper and lower halves of the pupil. Sometimes the division seems sectional in character.

Case of lenticonus posterior in a girl 7 years of age. Examination of the eye

with a concave mirror revealed a bright, circular patch, apparently about 4 millimetres in diameter, located between the iris and the fundus in the antero-posterior axis of the globe. Upon careful study of the reflexes, this was found to project beyond the normal curvature of the lens about 0.05 millimetre. The refraction of the eye through the centre of the lens was myopic about 12 dioptres, and through the periphery there was an hypermetropia of 3 1/2 dioptres. The base of the cone was probably 2.5 millimetres in diameter. At the apex there was a small opacity, possibly the remnants of fœtal blood-vessels. The eye had been convergent since infancy. The fellow-eye showed remnants of the fœtal pupillary membrane. Weeks (Archives of Ophthal., Apr., '91).

Case of lenticonus in a man 65 years of age. When the cone cannot be made visible by focal illumination the points which will enable a diagnosis to be made are: 1. The oil-globule-like disk. 2. The great difference in refraction between the margin of the lens and the central portion, the latter being always highly myopic. 3. The kaleidoscopic movements of the retinal vessels. 4. The exclusion of conical cornea. Knaggs (Lancet, Sept. 19, '91).

Cases of false lenticonus; diagnosis from true lenticonus by Purkinje's images. Demicheri (Annales d'Oeul., Feb., '95).

Literature of '96-'97-'98.

Lenticonus posterior in a 9-year-old girl. The refraction of the peripheral portions of the lens was + 4 D., while the central portion was — 11 D. Cramer (Klin. Monatsb. f. prakt. Augenh., Aug., '97).

Two rabbits' eyes with lenticonus posterior. Explanation is as follows: Lenticonus arises from changes in the posterior capsule, the hyaloid artery in process of absorption stretching, and finally rupturing, the capsule. Vitreous liquid then causes the lens-fibres to swell and protrude through the break in the capsule. Baeck (Archiv f. Augenh., xxxvi, 2, p. 160, '98).

6. Congenital Cataract. (See CATARACT.)

7. Remains of Hyaloid Artery and Branches.—Punctate opacities, usually situated a little to the inner side of the posterior pole of the lens, whitish by reflected, dark by transmitted, light, not interfering with vision, discovered incidentally, have been attributed by Ammon de Beck and Mittendorf to incomplete involution of the hyaloid artery.

They are stationary in character, vary in size from a mere point to a poppy-seed, and, although usually well defined, fine lines have been observed radiating from the edge in some cases.

In some cases of persistent hyaloid artery with attachments to the lens, straight vessels have been seen coming from the end of the disk-like attachment to the lens, and disappearing into the ciliary region at the margin of the pupil.

Parasites.—Three have been described as occurring in the lens: monostoma, distoma, and filaria, the latter occurring in opaque lenses and discovered after removal of the latter on account of the opacity.

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LEPROSY.

Definition.—Leprosy is a chronic disease closely allied to tuberculosis, acquired by inoculation with Hansen's bacillus lepræ, but only while the system is susceptible to infection through vital adynamia, inherited or acquired.

> [This definition differing etiologically from all those found in literature, it is merely submitted. It seems to advantageously group the solid data recorded and to throw light upon some mooted points. C. E. DE M. SAJOUS.]

Varieties.—It is customary to divide leprosy into two — sometimes three —

general forms, the *tubercular*, and the *anæsthetic*, the former being characterized by the formation of tubercle-like nodules; the latter by anæsthetic areas denoting a special involvement of the nervous supply.

[The two main forms differ only in respect to the tissues involved as a result of infection. In many cases they but represent individual stages of the disease and are often blended, the symptoms of both forms being present simultaneously. In text-books the peripheral manifestations are alone dwelt upon as initial symptoms; in this review, the early manifestations of the *typical* disease, those of the upper respiratory tract, will receive due attention. C. E. DE M. SAJOUS.]

Symptoms.—The earliest symptoms of leprosy in the majority of cases, according to Morrow (who claims to have first called attention to the early evidences in the nasal mucous membrane) and other observers, are alteration of the voice, betrayed by a slight husky or rough phonation—Besnier's *voix lépreuse*—which he likewise considers an early sign; rhinitis, with an abnormally free nasal secretion, sometimes epistaxis, and an increase in the salivary secretion.

Leprosy is always chronic. At its onset nasal or cutaneous involvement is first observed. Of the internal organs, the the lungs and the spleen are first affected; later, the liver and intestines; the kidneys very rarely. Albuminuria is uncommon. The nervous system is frequently involved. Goldschmidt (La Lèpre; Soc. d'Ed. Scientif., Paris, '94).

Sticker noted that the nasal membrane could appear normal in the first stage or at most show a slight increase of secretion. The first visible change is a simple dry catarrh in circumscribed patches, which eventually present a raw surface. In advanced cases shallow or deep ulcers are visible in one or both sides of the septum. Sometimes there is only a hard swelling, which may be extended to adjacent parts and produce stenosis.

Literature of '96-'97-'98.

Leprous lesions of the nasal fossa, the mouth, throat, and larynx found in 60 per cent. of the cases examined. Conclusions that chronic coryza is often the first exterior manifestation of leprosy, and that the nasal mucus of lepers is of great virulence and constitutes one of the most efficient sources of the propagation of leprosy. Jeanselme and Laurens (Bull. Méd., July 25, '97).

The systemic invasion of leprosy is usually slow, years rather than months constituting the period of incubation. Occasionally, however, its onset is sudden and the disease progresses rapidly. The prodromal symptoms are mainly those of general neurasthenia: anorexia, chilliness, slight ephemeral fever, mental inaptitude, etc. These manifestations occur by exacerbations, and their recurrence is attended by more or less marked impairment of sensibility and other cutaneous functions, perspiration, etc., over restricted areas, fugitive spots suggesting slight erythema.

After the foregoing symptoms have shown themselves with varying activity at various times, receding as often with more or less rapidity and completeness, the erythematous spots become more persistent, are more highly colored and sensitive to the touch, and project beyond the surface to a greater degree. They are reddish-brown, gray, dark-yellow or bronze, and of varying size from that of a dime to that of the palm. They may appear over any part of the body, the face, the trunk, and extensor portions of the limbs. After a time these spots also disappear, leaving a discolored patch, which in dark-skinned persons such as the residents of South American coun-

tries, appears white as compared to their surroundings.

> [In some cases I had occasion to see in Mexico the appearance of the patients suggested the spots on leopard skins. C. E. DE M. SAJOUS.]

TUBERCULAR FORM. — It is in this form that the naso-pharyngeal phenomena are most marked. The patient experiences slight difficulty in breathing through the nose and the symptoms pertaining to the air-tract already described become quite marked. Then comes the period during which the cutaneous lepromata of Leloir are formed. Localized nodosities appear over various regions,—the face and hands particularly,—varying in size from small shot to a chestnut. The skin appears much thickened, hardened, and puckered, wrinkles being turned into deep furrows; the hairs are often changed in color and fall out. The projecting portions of the head—the nose, chin, and ears—taking part in the thickening, the face acquires a characteristic expression which fully accounts for the horror inspired by these wretched cases. The extremities, especially the hands and feet, are generally affected in the same way. Their skin being thickened and furrowed, they stand out stiffly and are used with difficulty.

The thickened areas, or "tubercles," do not all follow the same course. Some recede, leaving a depressed or less pigmented spot, while others proceed to ulceration. These ulcers are usually small, vary in depth, and their borders, as in the case of syphilis, are sharp-cut and have indurated edges. They heal and reappear several times in succession. When the ulcerative process invades the deeper tissues, they destroy them; muscles, tendons, and even bone yield to its ravages; hence the mutilating effects of the disease. The mucous membranes of the mouth, tongue, pharynx, and larynx take part in the destructive process. The nasal bones and cartilages are markedly involved: the typical "saddle nose," indicating destruction of the supporting frame-work. A sniffling respiration indicates more or less complete obstruction to the respiration, by neoformations or depressed soft tissues.

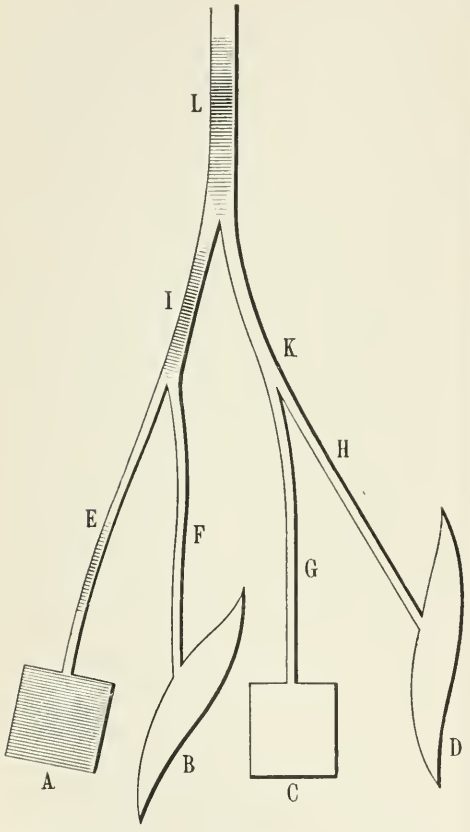
> Laryngeal examination of a series of cases of leprosy. In one the entire larynx was involved; the epiglottis was compressed laterally and curved backward; the vocal cords were covered with numerous round nodules; the mucous membrane of the subglottic space was thickened and pigmented, as was that of the aryteno-epiglottic ligaments. A second case showed diffuse generalized pigmentation and a small number of nodules. In a third case the larynx was filled with nodules, occupying especially the free part of the epiglottis; the superior vocal cords were irregular and the inferior left cord thickened. In a fourth the laryngeal mucous membrane was almost entirely destroyed, the ventricle and vocal cords were covered with many nodules, and there was considerable ulceration of the lower part of the cords. In a fifth case the internal surface of the larynx was completely destroyed, and in the sixth there was diffuse hypertrophy of the entire mucous membrane, but no nodules: Bergengrün (Univ. Med. Jour., Apr., '94).

Tubercular leprosy progresses slowly: eight or ten years, on an average. It is attended by eruptive and febrile exacerbations, each being followed by a period of comparative quiet. Gradually, however, the patient succumbs through invasion of the viscera, and death usually follows some intercurrent disease: pneumonia, pleurisy, etc.

ANÆSTHETIC LEPROSY.—In this variety the spots are not as numerous, and often begin in the palm and soles. They resemble those in the tubercular form, being erythematous and hyper-

chromic. But disorders of sensibility are more marked from the start: hyperæsthesia usually precedes anæsthesia, and may be discerned not only over the erythematous areas, but also over apparently healthy regions.

According to Dehio, leprous skin-spots do not correspond to the distribution of



Schematic drawing representing a mixed nerve. (*Dehio.*)

the nerves, but may spread in all directions. Baelz observed that when the body of a leper was rubbed with a powder of fuchsin methyl-violet, then covered closely with absorbent cotton, and pilocarpine was injected into the patient, the healthy perspiring skin became colored, whereas the leprous non-perspiring spots did not.

Leprous skin-spots do not correspond to the distribution of the nerves, but may spread in all directions. Schematic drawing represents a mixed nerve. *A* and *C* are portions of skin with their sensory nerve-twigs (*E* and *G*); *B* and *D* are muscles with their motor nerve-twigs (*F* and *H*); *I* and *K* are mixed nerve-fibres, while *L* represents the nerve-trunk. The shaded portions represent the localities of leprous infiltration. The patches of skin, (*A*) being infected with leprosy and becoming anæsthetic without involvement of the nerve (*E*), subsequently an ascending degeneration attacks the nerve-fibres of *E* and proceeds toward *I*. After a long time the leprous infiltration also reaches *E*, but does not produce any clinical change. So soon, however, as the mixed nerve (*I*) is reached, all peripheral to that becomes atrophied, and we have degenerative atrophy of the muscle, although neither it nor the motor nerve reaching it has been attacked by leprous infiltration. When, finally, the leprous infiltration creeps up and localizes itself at *L*, the whole nerve below this point becomes atrophied, including *K*, *G*, and *H*, which, nevertheless, are free from leprous infiltration. The result is: anæsthesia of the patch of skin (*C*), which itself is not affected with leprosy, and degenerative atrophy of the muscle (*D*). Dehio (St. Petersburger med. Woch., No. 42, p. 632 *et seq.*, '89).

The anæsthesia is so marked that pin-pricks, burns, etc., are not felt. On the other hand, prickling and violent shooting pains are often complained of, certain nerves, particularly the ulnar and brachial being sometimes greatly thickened and extremely sensitive to pressure. There is also exaggeration of the tendon-reflex. Paralysis of several muscles may occur, with all its attending complications. Considerable mutilation occurs in this form: the toes and fingers are destroyed, the loss being unattended by physical pain.

The general health gradually succumbs to the ravages of the disease, and, the viscera becoming involved, albu-

minuria, diarrhœa, pneumonia, or some other intercurrent disorder ends the patient's suffering.

Complications of Both Forms. — Ocular affections of leprosy were studied by Panas. In the anæsthetic form, lagophthalmos, xerosis of the conjunctiva and iritis, cataract, and phthisis bulbi are frequent; in the tuberculous varieties the cornea and conjunctiva are the chief seats of the lesion, though sometimes the iris, lens, and whole globe become implicated. The favorite seat is the corneo-scleral border, proceeding thence into the corneal substance and to the deeper tissues.

> The iris becomes the seat of colonies, and the parasite reaches the ciliary processes, but the number decreases toward the optic nerve. Lesions show that it proceeds from the surface to the inner parts of the globe. In the beginning the lesion is circumscribed, and does not seem to be a symptom of general infection. Poncet (Le Prog. Méd., p. 33, '88).

Mental disorders are occasionally observed, melancholia especially. Inflammatory and diathetic disorders of the brain and spinal cord have also been noted. Of the 36 autopsies of maculo-anæsthetic form studied by Havelburg, there were 2 cases of simple meningitis, 1 tubercular meningitis, 1 of nodular tuberculosis of the cerebellum, 2 of hydrocephalus, 2 of degeneration of the posterior columns of the spinal cord, 1 of atrophy of the spinal cord, and 1 of thickening and hyperæmia of the lumbar portion of the spinal cord.

Literature of '96-'97-'98.

> Leprosy exerts a direct influence on the development of dementia, the cerebral phenomena resulting possibly from some irritating lesions of the nervous system, brought on either by Hansen's bacilli or by their toxins. Mesenedes (Section of Neurol., Inter. Med. Congress, Aug. 19-26, '97).

> Ten autopsies of lepers who had died in the leprosy of Riga, and in four of these cases there were adhesions between the dura mater and the brain; in three of these four cases of adherent meningitis lepra bacilli were found on a level with the pituitary gland. C. Brutzer (St. Petersburger med. Woch., Oct. 17, 19, No. 42, p. 363, '98).

Lepers, male and female, suffer from marked deterioration of the genital functions, and male lepers generally become impotent.

> Of 118 cases of leprosy in the Punjab, 73 cases married before the onset of the disease, viz., 43 males and 30 females; and, while still healthy, the males had 71 children, mostly now living free from the disease, and the females had 65; total, 136. After the disease had declared itself only 4 females gave birth to offspring,—5 in all. Sixteen males and 23 females married after leprosy had declared itself. Seven married more than once; thus, one man married five wives in succession, and several others married two or three times. The men contracted 26 marriages, the women 29. Only 5 men proved prolific, with 10 children, and 8 women with 15 children. Four children are dead; so that we have left 21 as the progeny of 55 marriages. Gulam Mustafa (St. Louis Med. and Surg. Jour., May, '91).

Diagnosis.—The diseases from which leprosy requires differentiation are syringomyelia, ainhum, tuberculosis, and syphilis. The similarity between leprosy and the two diseases first mentioned is such that they have been considered identical by some competent observers.

Syringomyelia.—In this disease Hansen's bacillus is absent. The frequent rise of temperature characterizing leprosy does not attend syringomyelia. Though both diseases progress slowly, the active symptoms—headache, paræsthesia, neuralgic pains—appear earlier in the former, while the dermal, muscular, vasomotor, and skeletal morbid

changes do not appear in the regular order as they do in syringomyelia. The hands and feet are first involved in leprosy; in syringomyelia the proximal parts of the limbs are first attacked and the destructive process is less marked.

Syringomyelia and leprosy are substantially different affections, both in regard to their etiology and nature, notwithstanding the fact that some cases present a certain analogy in the symptoms. The differential diagnosis between these two diseases is sometimes very difficult. Pitres and Sabrazès (Archives Clin. de Bordeaux, May, '93).

While not all cases of syringomyelia are to be pronounced as leprosy, at least all those of Morvan's type should be. Prus (Pharm. Post, Nos. 48 to 52, '93).

Case of "systematic nervous leprosy, syringomyelitic type," in which only bacteriological examination determined the true affection. In the portion of nerve excised from the living patient the bacillus of leprosy was found in great numbers, limited, however, to the nerve-fasciculus itself, none being found in the perineum, the intrafascicular tissue, nor in the vessels. Pitres and Sabrazès (Nouvelle Icon. de la Salpêtrière, No. 3, '93).

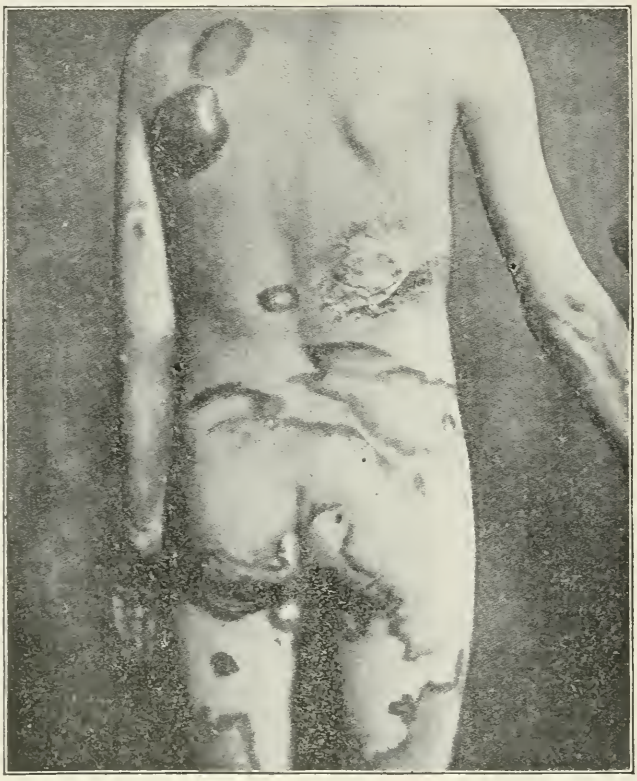


Fig. 1.—Posterior aspect of a case of leprosy of the mixed type. (*Hersman and Lyon.*)

Leprosy often first manifests itself as a non-characteristic macule. The demonstration of lepra bacilli in these spots is of the highest importance. The lesion should be excised, taking tissue beyond the anæsthetic zone, and search for the bacilli must be made in the entire thickness of the derma. Marcano and Wurtz (Arch. de Méd. Exper. et d'Anst. Path., Jan., '95; Univ. Med. Mag., Apr., '95).

According to Evaristo Garcia, the process of resorption of phalanges in the nervous leprosy of tropical South America is perfectly comparable to the process of destruction of the bones in the tabetic. Ashmead (Jour. Amer. Med. Assoc., Mar. 16, '95).

Literature of '96-'97-'98.

Case of mixed leprosy, illustrating both the distribution of the anæsthetic areas and the muscular degeneration and contraction following leprous neuritis. The lesions produced by syringomyelia have frequently a strong superficial resemblance to indistinct cases of leprosy, but the absence or presence of the distinctive bacillus is enough to distinguish the diseases. C. F. Hersman and H. N. Lyon (Inter. Med. Mag., July, '96).

The pathology as well as the symptomatology of leprosy and syringomyelia afford sufficient means for differential diagnosis.

Symptoms characteristic of leprosy—circumscript areas of anæsthesia, atrophy of muscles, and trophic and vasomotor changes in the skin, bones, and joints—appear in no regular order. In syringomyelia the sequence of symptoms depends upon the seat of the disease in the spinal cord; when, as in most cases, the cervical or dorsal segment is affected, then the upper extremities will be first attacked; the lower may escape for years, and conversely. The face escapes nearly always, or suffers only in the latter stages.

Leprosy attacks chiefly the small muscles of the hands and feet, more seldom those of the forearm or leg; syringomyelia begins in the proximal parts of the extremities; a scapulo-humeral type is pretty frequent.

In leprosy the sensations of pain and temperature and of touch are either impaired or entirely absent; in syringomyelia the sensation of touch remains intact.

A slowly-progressing curvature of the spine and disturbance of the function of bladder and rectum further characterize syringomyelia; spindle-shaped thickening of the branches of the peripheral nerves, especially the peroneal and ulnar nerves, distinguish the early stage of leprosy. M. Laehr (Berliner klin. Woch., Jan. 18, '97).

Ainhum.—Though Zambaco considers that etiologically ainhum and leprosy may be identical, their clinical aspects are sufficiently dissimilar to prevent errors in diagnosis. Ainhum occurs exclusively in negroes, and consists in the amputation of the little toe by an adventitious fibrous band. Hansen's bacillus has never yet been found in the diseased tissues.

Tuberculosis.—From this disease leprosy is differentiated mainly by the bacillus and through the absence in tuberculosis of anæsthetic areas. The injection of tuberculin may, according to Babès and Kalindero, assist in the

Fig. 2.—The so-called "leper-claw." (*Hersman and Lyon.*)

differentiation. In tuberculosis the general reaction, after the injection of tuberculin, begins about six hours after inoculation; in leprosy it generally comes on twenty-four, or, less frequently, in twelve hours after inoculation.

Literature of '96-'97-'98.

Three cases of lepra with ulcers in the intestines. In two of these there was at the same time tuberculous disease of the lung. The ulcers, however, were distinguished by great thickening and bluish coloration of the edges. In the third case the ulcer was flat, rounded, and with a sharp edge. No tuberculosis of other organs could be discovered. Microscopically lepra bacilli were found in the third case, while in the ulcers of the first and second bacilli could only be found.

Von Reisner (Monats. f. Prakt. Derm., No. 5, '96).

Syphilis.—The course of this disease usually serves to facilitate diagnosis, while Hansen's bacillus is not to be found. Fournier states that general or local analgesia and anæsthesia are frequently observed in syphilis; he found, however, that, if present at all, they occur on the dorsal surface of the metacarpal portion of the hand.

A case of tubercular syphilis bearing so close a resemblance to tubercular leprosy that the patient, while undergoing antisyphilitic treatment, was arrested and confined in a leper hospital. The woman had a typical "facies syphilitica leontiasis," as described by Goutard; the trunk was free from lesions, but there were numerous typical tubercular syphilides scattered over the extremities, especially on the extensor surfaces of the forearms. Analgesia and anæsthesia were present over all the spots, and also in the apparently normal surrounding skin, especially on the dorsal surface of both metacarpi. At the end of five weeks of specific treatment she was released from the leper hospital greatly improved. McMurray (Australasian Med. Gaz., Apr. 15, '93).

Etiology.—That leprosy is but slightly contagious is the opinion of the great majority of dermatologists. Not only have repeated inoculations failed to give rise to the disease, but cases have been reported showing that a person may reside with a leper, sleep and eat with him, nurse him, handle and wash his linen, and even wear his clothes with impunity.

In spite of the general diffusion of the disease, those who know most about it doubt its contagiousness. In numerous mixed marriages coming under personal observation the disease has never been transmitted from one party to the other. Often a single member of a family is a leper, and yet mingles without restraint with the others, adults and children. Nurses and attendants in leper hospitals, often religious devotees, care for lepers and live in their midst for years without contracting the disease. Zambaco (Bull. de l'Acad. de Méd. de Paris, No. 32, '89).

Literature of '96-'97-'98.

Analysis of 1034 cases of leprosy in every stage of the disease. Not a single case could be traced to contagion such as sleeping with, eating with, or nursing a leper, and handling or wearing his clothes. Chew (Med. Age, Dec. 27, '98).

Still, there is considerable testimony in literature tending to prove that leprosy is contagious under certain circumstances, as will be shown under Prophylaxis. Observers who have had occasion to study large numbers of cases generally uphold this opinion.

Clinical evidence tends to demonstrate that leprosy is not hereditary in the true sense of the word (though a fœtus may be infected by a leprous parent and be leprous at birth), but that a proclivity to the disease is inherited by the offspring, and that exposure, in his case, will lead to its development.

In order to produce the contagion, it is necessary that the person contracting the disease be under the influence of certain special conditions, and surrounded by certain causes, and that his system be prepared beforehand to receive the leprous germ: in other words, the ground must be prepared for the planting of the seed.

"I have observed many cases in which the disease has passed from generation to generation, and have noticed that leprosy, unlike most hereditary complaints, rarely disappears in one generation to reappear in the next. One of the patients being a leper, the son is in imminent peril, even should he have been procreated before the appearance of the first symptoms in the parent." Flores (Satellite of the Annual, Nov., '87).

Parasitism does not necessarily involve the idea of contagion, and it would be an error to believe that every bacterial parasitic disease can be transmitted from

the affected person to those who live with him. The latter must be in an especial condition of receptivity in order that contagion may occur. Cornil (French Acad. of Med., Annual, '89).

In the Delta, situated two kilometres from the French Concession of Hanoi, and containing 400 inhabitants, almost one-half are affected with leprosy. Eighty to 90 per cent. of the children of lepers contract the disease, which usually appears for the first time about the eleventh year. Editorial (Brit. Med. Jour., Jan. 3, '91).

Leprosy is a family disease, and children of lepers more easily acquire leprosy by early infection. Arning (Archiv f. Derm. u. Syph., H. 1, '91).

Literature of '96-'97-'98.

Leprosy is certainly not hereditary, and can only be spoken of as possibly contagious, an absolute demonstration of infection from direct contact being still lacking. Possibility suggested that human beings are but temporary hosts of the parasite, it having possibly some extrahuman habitat. K. Grossman (Brit. Med. Jour., Dec. 5, '96).

Leprosy, particularly as it occurs in Iceland, has increased somewhat in recent years. Of 119 cases examined, in 56 there was a history of the disease in the family. Of these, the father and mother were affected in 3; father alone in 15; mother alone in 4; sisters or brothers in 4; distant relatives in 14. Ehlers (Derm. Zeit., No. 3, '96).

Investigation of 1034 lepers. Of these 10 were born leprous; 21 contracted leprosy from their parents before puberty. The disease skipped the first generation to attack the second in some, and the third in others. There were 15 that were born leprous, of healthy parents. R. S. Chew (Med. Age, Dec. 27, '98).

Conditions capable of sufficiently reducing the vital resistance of the organism — insufficient or unwholesome food, excessive use of salt, a fish diet, exposure to cold and damp, alcoholism, malaria, overwork, syphilis, tuberculosis, etc.—are recognized predisposing factors. They seem, in my opinion, to render the organism susceptible to the influence of the leprosy bacillus precisely as does heredity.

> In neither of its true forms is true leprosy really infectious, and if it be contagious, which is personally disbelieved, its contagion is extremely sluggish and operative only under telluric, atmospheric, and other external conditions predisposing to its independent development. George Birdwood (Asiatic Quarterly, Apr., '90).

According to Jeanselme and Laurens, and Sticker, lepers eliminate the bacillus of leprosy in enormous numbers through the upper respiratory tract and particularly the nasal cavities. During the active stages of the disease the nasal secretions and the sputa of the subjects thus disseminate the bacillus of leprosy, by emptying their nostrils and expectorating over the restricted grounds in which they are segregated.

Literature of '96-'97-'98.

> Leprosy is essentially a Chinese disease, extending from its focus in the southeastern provinces to every region visited by the lower class of Chinamen, and to no others. James Cantlie (Lancet, Jan. 1, '98).

The telluric origin of leprosy would thus find an explanation. Though but slightly communicable by the leper himself when free, his compulsory segregation within a certain area of ground would thus cause him to transform this area into a focus of infection. His sputum, nasal secretion, and other contaminated ejecta would play the rôle in leprosy that the sputum plays in the propagation of tuberculosis.

> [In formulating this hypothesis I wish to emphasize the fact that it is only supported by collateral evidence. Still it seems to clear many mooted points. It was therefore deemed sufficiently sug-

gestive to merit incorporation in these columns. C. E. DE M. SAJOUS.]

Literature of '96-'97-'98.

Personal view that leprosy is of telluric origin. Long-continued intimate contact with lepers is often suffered with impunity, while leprosy is often contracted when there has been no conscious contact with any leper. Evidently the discovery of the bacillus lepræ does not necessarily imply that leprosy is spread by personal communication. Tetanus is an infective disease, but it is seldom if ever maintained by communication between those suffering from it and the healthy. Ashburton Thompson (Brit. Med. Jour., May 7, '98).

A subject predisposed by heredity or debilitating factors could thus become infected in various ways by dust or water contaminated with secretions containing Hansen's bacilli. The upper respiratory tract is particularly exposed to infection through dust inhaled. The breath of the patient, especially during the act of sneezing, has been found charged with bacilli, and the air so charged may come into contact with the nasal mucous membrane of persons in the immediate vicinity.

Literature of '96-'97-'98.

The front part of the nasal mucous membrane and the greater portion of that covering the nasal sputum, is the region which leprosy first, and perhaps always, attacks. One hundred and forty-three lepers examined to ascertain this fact. In 55 out of 57 cases of tubercular leprosy the leprous bacillus was found in the nasal secretion, and yet in only 2 cases were there any leprous nodules in the nose. In 45 out of 68 cases of anæsthetic leprosy, and in 27 out of 28 of the mixed form, the bacillus was also found.

In 23 out of 153 cases there was evidence of disease in the bronchi, but in only 14 of these were leprous bacilli found in the sputum. In 10 out of 27 cases in which the exudation from the ulcers was examined, the leprous bacilli was found. In 21 cases the bacillus was demonstrated in the secretion of the fauces in 9 instances. Sticker (Münch. med. Woch., Nos. 39 and 40, '97).

Experiments showing that very great numbers of bacilli were given out in sneezing,—in one instance more than 110,000. Conclusion that in lepers in whom there is an affection of the mucous membranes of the air-passages, not necessarily of an extreme grade, thousands of bacilli are thrown out to a considerable distance in speaking, coughing, and sneezing, and that this dissemination cannot be prevented by therapeutic measures. Dissemination of the bacilli from the upper air-passages is relatively the most important of the various ways of infection. Schäffer (Archiv f. Derm. u. Syph., '98; Boston Med. and Surg. Jour., Mar. 16, '99).

Abrasions and solutions of continuity of the skin or mucous membrane, etc., may thus also afford an entrance to the specific germ.

Literature of '96-'97-'98.

Twenty-six cases observed in which inoculation occurred through accidental abrasions and other injuries. Chew (Med. Age, Dec. 27, '98).

Morrow advanced the theory that, like syphilis, leprosy was usually communicated by sexual intercourse. In Chew's statistics but 7 cases out of 1034 can be traced to coitus: but, as already stated, the period of incubation of the leprosy is long and the disease may thus frequently be communicated and show signs of its existence long after intercouse. Hansen's bacillus has been found in semen.

Literature of '96-'97-'98.

In the hospitals in Rio Janiero some of the attendants have been attacked in spite of thorough precautionary measures. Period of inoculation appears to be, in some cases at least, as much as two years, and may possibly be longer. The disease is frequently associated with

tuberculosis. Havelburg (Berliner klin. Woch., Nov. 16, '96).

Women in China are active disseminators of infection, "selling the disease," as they called it, in the belief that they can free themselves by coitus with a healthy man. James Cantlie (Lancet, Jan. 1, '98).

Of the 1034 cases studied 624 were married, and in 4 cases only did the husband infect his wife, while on 3 occasions the wife infected her husband. While 44 of the married lepers had had no children, there were no fewer than 1566 conceptions. R. S. Chew (Med. Age, Dec. 27, '98).

[Dr. Chew's statistics seem to invalidate the view that impotence accounts for limited birth-rate among lepers. As in the case of syphilis, it is more probable that the influence borne exerts itself upon fœtal development. C. E. DE M. SAJOUS.]

Sex does not seem to have much influence upon the development of the disease, though male lepers are by far the more numerous. It may attack children as well as adults, but it is most frequently met with in persons between twenty and forty-five years of age: the period of life attended by the greatest exposure.

Literature of '96-'97-'98.

From an investigation of 1034 lepers in every stage of the disease the annexed table gives the conclusions reached as to etiology. Roger S. Chew (Medical Age, Dec. 27, '98).

Distribution.—Leprosy is most prevalent in India, where, according to Zambaco, there are 130,000 cases; but the disease is thought to be increasing. It is also met with extensively in China; but less so in Persia, Japan, Tonquin, Siam, Anam, the Antilles, and South America.

It is estimated that there are 30,000 lepers in the departments of Boyaca and Santandeo, in the United States of Colombia. E. H. Plumacher (Abstract of Sanitary Reports, Nov. 13, '91).

Leprosy also exists in Norway, Sweden, Russia, Spain, Italy, Roumania, Greece, Turkey (at least 4000), and in a modified and light form in France.

In the English-speaking sections of North America the cases are comparatively few. An inquiry by Dr. Osler has elicited the fact that there were five foci, two in Canada, aggregating about 40 cases, and three in the United States,

LEPERS BY NATIONALITY AND HOW DISEASE WAS OBTAINED.	Proved to climatic and telluric causes.		Proved to food and drink.		Proved to direct blood-taint—*i.e.*, heredity, inoculation.		Leprosy to other causes.		Total cases.		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Both Sexes.
Adults.											
Europeans and East Indians	44	8	9	9	48	15	10	10	111	42	153
Mohammedans	68	22	66	22	50	3	44	5	228	52	280
Hindoos	87	20	50	24	37	14	77	18	251	76	327
Other races	33	1	39	26	17	6	13	1	102	34	136
Total	252	51	164	81	152	38	144	34	692	204	896
Children.											
Europeans and East Indians	4	..	2	1	12	4	1	..	19	5	24
Mohammedans	1	1	1	..	13	4	1	..	16	5	21
Hindoos	11	2	3	2	31	12	6	3	51	19	70
Other races	3	2	..	2	7	6	2	1	12	11	23
Total.	19	5	6	5	63	26	10	4	98	40	138
Total of all ages.	251	56	170	86	215	64	154	38	790	244	1034

aggregating about 300 cases. Dr. I. Dyer, at the Berlin Leprosy Conference, reported that there were 126 cases in Louisiana. Wisconsin and Minnesota are computed to contain about 150, all Swedes and Norwegians. The cases are gradually decreasing in number. In the Hawaiian Islands, according to Morrow, there are about 1200 cases at Molokaï. Sporadic cases are occasionally met with in our cities.

Since 1866 five deaths from leprosy have been reported in New York. Editorial (Brit. Med. Jour., Dec. 19, '91).

Pathogenesis.—A specific bacillus closely allied to the bacillus of tuberculosis has been shown by Hansen in 1871 to be the exciting cause of leprosy. The labors of Neisser have confirmed Hansen's discovery. The bacillus lepræ is a long and slender, motionless rod, with slightly-tapering ends. It reacts in the same way that the tubercle bacillus does to coloring reagents, but much more readily—a distinctive feature—and takes aniline dyes, which tubercle bacilli do not. Again, the bacilli of leprosy are usually much more numerous.

Literature of '96-'97-'98.

Method adopted and now advocated for bacteriological diagnosis of leprosy is exceedingly simple. A cover-slip is smeared with a drop of the serum obtained by scraping one of the leprosy-nodules. This is stained with carbol-fuchsin and decolorized with sulphuric acid and methylene-blue (Gabbett's fluid). It may then be examined under the microscope.

In tuberculous lesions of the skin the bacilli are always very scanty, and usually only a few are found in the entire cover-slip; but in lepra each microscopic field shows enormous numbers of them. The lepra bacilli also readily stain by the simple aniline dyes, while tubercle bacilli do not. In choosing a nodule from which to take the specimen, it is desirable to select one in an early stage of development, before much scarring has taken place. Johnston and Jamieson (Montreal Med. Jour., Jan., '97).

The bacillus of leprosy is found in all cases, but reliable cultures have not been obtainable so far; while experimental inoculations, as previously stated, have given no results. Still, fragments of nodules introduced into a rabbit's eye by Melcher and Ortmann caused development of the disease in the animal and death. Arning thought he had successfully inoculated a condemned criminal with matter obtained directly from a leper, but the subject was subsequently found to belong to a family (including his son and nephew) in which the disease existed: a fact demonstrating his proclivity to the disease.

[Arning's case seems to show that previous inoculation experiments in man were negative because the subjects were in sufficiently good health to antagonize the influence of the pathogenic germ.

This would suggest that a subject rendered susceptible by the various factors capable of inducing adynamia could temporarily become liable to infection when exposed to the disease, and remain so as long as his physical debility would last. Even under these circumstances the period of incubation could be a prolonged one. C. E. DE M. SAJOUS.]

The introduction of the virus through abrasions, scarification with medicinal substances and vaccination, which together represented almost one-fourth of the etiological factors noted by Chew in his 1034 cases, demonstrates that transmission by inoculation is, in reality, an important factor in the pathogenesis of the disease.

The bacilli are to be found in all tissues and liquids of diseased areas only, and particularly in the lepromata.

[Repeated examinations have failed to show bacillus lepræ in the blood-cur-

rent of lepers, excepting in the immediate neighborhood of lesions. ARTHUR VAN HARLINGEN, Assoc. Ed., Annual, '92.]

Lepromata found to contain large numbers of bacilli. In recent cases the bacilli are almost all present in the cellular elements. Later they multiply, forming a globular mass, and the cell becomes gradually destroyed, freeing the bacilli. With the juice of a cutaneous non-ulcerated leproma, inoculations made on blood-serum and on glycerin-agar, the tubes being kept at a temperature of 98.6° F. Cultures developed in all the tubes. Growth was arrested at 68° to 77° F. Giantureo (Gior. del Assoc. Napolitana di Med., etc., '91).

In general, the bacilli develop at the same time in the fixed cells of the connective tissue and the migratory cells. The proliferation of the cells is remarkably slow, notwithstanding the great number of bacilli, and is not induced in their immediate vicinity; in the periphery of the bacillar foci the tissue is healthy. In the cells the bacilli multiply more and more and there finally form small, brownish, globular masses, in which the bacilli are very numerous and close to one another. At this stage the softening of the leprous nodules begins, the degenerative evolution of which thus differs decidedly from the caseous degeneration of tubercle. Lie (Archiv f. Derm. u. Syph., B. 29, H. 3, '95).

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The bacillus is demonstrable in the macules; the macules are of the same histo-pathological structure, whatever their clinical form; through gradual stages the macules may pass into fully developed nodules, having the same nature as the nodules.

In the early diagnosis of this disease the possibility of demonstrating the bacillus is of great importance. J. Darier (Ann. de Derm. et de Syph., vol. viii, No. 12).

Leprosy is contagious only after a very intimate and long-continued intercourse. Autoinfection within the body takes place by dissemination of the bacilli through the muscular system. E. Baelz (Berliner klin. Woch., vol. xxxv, Nos. 46 and 47).

Lepra bacilli demonstrated upon the skin in cases of leprosy with cutaneous manifestations. The bacilli are absent from the skin when cutaneous manifestations are wanting. Gravagna (Riforma Med., No. 138, '96).

Secretions and tissues of a case of leprosy examined; bacilli found in the blood of diseased tissue, sweat, epidermis, and sperm, but not in the blood of healthy tissues, in the urine, or sputum. Faber (Deut. med. Woch., June 1, '97).

In cases with tubercles the bacilli are found in many tissues of the body, while in those without tubercles they are confined to the nerves. In the anæsthetic forms the bacilli cease to exist after a few years. Many cases will present no bacilli at the end of three or four years. The tubercular forms are the only ones concerned in spreading the disease. S. P. Impey (Lancet, Sept. 25, '97).

The blood of lepers in various stages of the disease was carefully studied by Winiarski. When leprosy has not given rise to great changes in the organism, the composition of the blood is not much altered. No change in its composition, in the various forms of leprosy (anæsthetic, nodose, and mixed) could be demonstrated. In chronic cases the number of blood-corpuscles was always found to be diminished, on an average, 17.9 per cent. in men and 12.3 per cent. in women. The hæmoglobin was decreased, on an average, 6.3 per cent. in men and 2.4 per cent. in women. The white blood-corpuscles were usually normal in quantity. In all cases of leprosy a large preponderance of multinuclear leucocytes was noted.

Prophylaxis. — At the International Conference on Leprosy, held in Berlin in 1897, the conclusions reached were the following: (1) the leprosy bacillus discovered by Hansen is the true cause of the disease; (2) man is the only animal in which that bacillus exists; (3)

leprosy is contagious, but is not an hereditary disease; (4) isolation of leprous patients is desirable, and under such circumstances as exist in Norway; (5) compulsory isolation is to be recommended.

Results of segregation in Norway: In 1856 there were 2871 lepers in Norway and now there are hardly 800.

In all countries where leprosy is met with endemically, isolation has proved the most useful method of preventing the spread of the disease. The worse the social relations, the greater is the danger from contagion. Hansen (Monats. für prak. Derm., B. 25, No. 9).

That segregation is an effective prophylactic measure for the protection of the public at large against leprosy is undoubted. The same statement would be applicable, however, were syphilitic, tuberculous, and other infectious subjects to be compulsorily isolated and ostracized from society. Indeed, it would apply more forcibly, since all the evidence at our disposal tends to prove that leprosy is one of the least contagious of infectious disease, though undeniably so in predisposed individuals.

A handsome young lady of good family married a leper, and lived with him eight years. Partly through jealousy on his part, and partly through devotion on hers, they made every effort to share the leprosy in common. The leprous husband caused her to kiss his ulcerated tongue constantly, and numerous attempts at inoculation were made. Nevertheless, the husband finally died of leprosy, while the widow still lives in perfect health. Zambaco ("Des Affections Nerveuses Syphilitiques," '62).

Of the 156 Norwegian lepers settled in Minnesota, only 12 or 14 are now dead. It is, indeed, strange that these lepers have not communicated the disease by heredity or contagion. It is because their habits in the old country were so slovenly, and because they herded together; whereas, in America they become cleanly and live a less promiscuous life. Each of the lepers personally seen in Minnesota had his own bed and his own room. A. Hansen (Edinburgh Med. Jour., June, '91).

[Kuusamo, Finland, was for a long time a small, but obstinate, focus for leprosy, 16 deaths having occurred between 1774 and 1800, and 22 between 1800 and 1828. In 1807 the lepers were isolated, and remained thus until 1845, when the hospital system was abolished, and the lepers were visited twice a year in their own houses by the medical officer of the district. After 1865 no further reports were presented, and in 1871 the medical officer reported that he was unable to find any more cases of leprosy in Kuusamo. WALTER WYMAN, Assoc. Ed., Annual, '92.]

Literature of '96-'97-'98.

Some of the victims at D'Arcy Island were removed from white homes where they were employed as cooks, yet no whites in the city here ever contracted it. Ernest Hall and John Nelson (Dominion Med. Monthly and Ontario Med. Jour., Dec., '98).

The bacilli of leprosy are only found in diseased tissues and in the blood, discharges, etc., of the latter. It is a question, therefore, whether the healthy areas of skin and mucous membrane are not subject to reinfection from external causes (see ETIOLOGY) capable of inducing the disease in any predisposed subject.

[Autoinfection in chancroid offers a precedent of this kind, although no specific germ is at present thought to act as intermediary. Even in true syphilis well-authenticated cases of autointoxication have been observed.

Reinfection in syphilis tends likewise to sustain the view that reinfection in leprosy is quite possible. A series of cases accurately reported by trustworthy observers have led Horovitz (Allg. Wiener med.-Zeit., Sept., '93) to conclude that "the doctrine that there can be no recurrence in syphilis has been forever refuted." In all the cases reviewed at least

the secondary manifestations had recurred.

Successful inoculation experiments were performed by Bouley (Jullien, "Maladies Vénériennes," Paris, '85). This author inoculated a patient suffering from tertiary manifestations; a chancre resulted, followed thirty days later by general manifestations. These experiments were successfully repeated by Horand. Wallace also obtained by inoculation a chancre in a case of secondary syphilis. A large number of cases could be cited in support of the contention that even in syphilis immunity is not invariably acquired through the first infection.

Considering (1) the slow progress of the bacillus leprosæ through the tissues, (2) the fact that diseased regions alone contain the organism, and (3) that the general blood-stream contains no bacilli, the belief seems warranted that the uninfected areas of a leper are liable to contamination, through solutions of continuity of the mucous surfaces or of the skin, epithelial denudation, absorption into the gastro-intestinal canal, etc., when brought into contact with leprosy bacilli of external origin.

The natural history of the organism is not sufficiently known to warrant for this view more than the position of a working-hypothesis. C. E. DE M. SAJOUS.]

Segregation within a restricted district under such circumstances would greatly compromise the chances of recovery of the sufferers so segregated. Constantly-exposed to contaminated soil and surroundings, reinfection would seal the doom of many who, under the influence of hygienic surroundings, would be restored to health by appropriate treatment. Lazarettos, pest-houses, etc., would thus become foci of infection.

It is probable that the mouth and nasal cavities are the avenues of entrance of the bacillus leprosæ. Leprosy is contagious, but not hereditary. Hansen (Monats. f. prak. Derm., B. 25, No. 9).

This is strongly sustained by the fact that in such institutions practically all the patients die of the disease or its complications, while, among lepers only exposed to the average contaminating influences of cities, many are saved.

Literature of '96-'97-'98.

Of 1034 cases of leprosy observed during a period of 14 years and 9 months, 422 have been cured of their loathsomeness, while medicines failed to make any lasting impression on the remaining 612. R. S. Chew (Med. Age, Dec. 27, '98).

According to Morrow's computation, the number of lepers in the Molokaï settlement (Hawaii) averages about 1200, but he contends that, notwithstanding the optimistic view of the health authorities that leprosy is on the decrease, the annual consignment of lepers to the settlement shows but little, if any, diminution. "All the indications point to the existence of a vast deal of latent leprosy, which, as the disease develops into a recognizable form, must continue for many years to come to furnish a constantly-recurring series for the leper colony."

What probably does exist in Hawaii is a large number of vulnerable individuals, vulnerable through the operation of the various factors enumerated, and especially active, in our new possession, on account of the deteriorated state of the natives. These etiological factors, as well as susceptible subjects, are to be found in all countries and especially in districts where poverty, filth, bad food, and alcoholism prevail. Were compulsory isolation abandoned, therefore, leprosy—like syphilis, tuberculosis, cancer, etc.—would assume the position of a general disease, its development being commensurate with its low degree of contagiousness and the hygienic level and customs of the communities exposed. In the United States the debilitating influence of excessive and unduly prolonged physical and mental activity

would tend to increase vulnerability, and the dissemination of leprosy might thus be greatly enhanced.

Literature of '96-'97-'98.

In all countries where leprosy has become epidemic its advance is insidious; it spreads slowly, and, before the health authorities awaken to a realization of the danger, it has made such headway that its further progress cannot be arrested. Morrow (N. Y. Med. Jour., Nov. 7, '96).

Segregation of lepers is, therefore, imperative, but only on the condition that they be compensated for their isolation on behalf of others by adequate protection against continued infection and by the most conscientious efforts to restore them to health and to their families.

Literature of '96-'97-'98-'99.

According to Brocq, the first leper, a Chinese coolie, was discovered in the vicinity of Honolulu in 1853. Eight years later several lepers were found among his associates, and twenty years after this (1880) with a population of 44,000 people, there were 2000 lepers upon the Hawaiian Islands (statistics of Wood, White, and Tyson).

A leprous fisherman, who came from San Mauritius to the Island of Rodriguez, infected this place. The island of Pinez was, according to Fourne, infected by prisoners brought from New Caledonia. Eight years later the disease broke out among the natives.

Zuranga reports that a leprous sailor, while visiting in Parcent, infected the friend and the brother of the friend with whom he was stopping. The former infected a friend, who, in his turn, infected a number of his acquaintances.

Fourne found that Toured, a village near Nice, was, up to 1850, free from leprosy. During this year, the family, M., engaged a leprous servant, and following this both M. and his wife contracted the disease: subsequently in the family G., with whom the M.'s had associated, a cousin of the family G., his wife and three children, became affected.

Ghose saw a case in which the wife became infected by her husband. After the death of her husband she returned to her former home, a village free from leprosy, where she lived in the house of her brother. The brother became affected; and during the next six years three persons in the neighborhood.

The infection of physicians and clergymen in contact with lepers (Dr. Robertson, Father Damien, Father Boglioli, Pastor Becker, etc.) are well known. These cases are only a few of the great many which can be found in the literature. Those mentioned are particularly conclusive and direct. E. O. Jellinek (Progress of Med., Feb. 1, '99).

In some "settlements," "lazarettos," or "pest-houses" these unfortunate *patients* (some of which may not be leprous and be suffering from tuberculosis, syringomyelia, or syphilis) are practically assimilated to criminals awaiting the death-penalty, while neglect, both general and professional, is insidiously acting as executioner.

Literature of '96-'97-'98.

About a league off the eastern coast of Vancouver Island, and separated from it by the waters of the Gulf of Georgia, lies the pretty little island of D'Arcy. . . . Hidden away in their little cabins under the grateful shade of the fir, with their hot blood burning out their life, the victims of this plague are slowly dying with their faces to the rising sun. . . .

Following the policy of isolation, most notably exemplified at Molokaï, in Hawaii, and also adopted at the Tracadie Lazaretto, in eastern Canada, the Victoria City Council, eight years ago, removed the victims to D'Arcy Island, where a line of huts, all under one roof, were erected for their accommodation. . . . Here the unfortunate sufferers are regularly supplied with rations and properly provided for without imperiling public health. . . . *Every three months* the sanitary officer of the city of Victoria visits the settlement with a sufficient supply of food for the following quarter. . . .

As our dory grates on the shore, and we hurry up the incline to their homes, the real wretchedness of their condition becomes evident. . . . Every development and every type of this loathsome disease is apparent in the little group before us. . . .

The monotony of the existence of these unhappy creatures can hardly be described. No change in its recurring miseries is noticeable save the transformation which comes over their little world with the return of the seasons. . . .

Since the establishment of the station only one white man has been incarcerated upon it. He was shunned by his Mongolian fellow-sufferers, and, as in a community of this kind, the patients are dependent upon one another for mutual assistance, *the white victim speedily sank, from neglect and loneliness.* . . .

The station is maintained on the principle of the strong helping the weak (!).

The supplies, *including the coffins,** are placed in a storehouse, and each man helps himself as necessity requires. Ernest Hall and John Nelson (Dominion Med. Monthly and Ontario Med. Jour., Dec., '98).

[*All italics are mine. C. E. DE M. SAJOUS.]

Such neglect on the part of municipalities — such wretchedness — is not compatible with modern civilization. Sanitary regulations to protect communities involving the sequestration of innocent sufferers should not destroy with one hand to save with the other. All should come in for their share of the benefits, if equity is to prevail and if the cruelties of the dark ages are not to be perpetuated. Consumptives, inebriates, the insane, etc., enjoy all the advantages of well-appointed and comfortable sanatoria; so should the leper receive his share of all that human compassion can afford to relieve him of physical sufferings and of the mental torture that ostracism entails.

A sanatorium for lepers should, in the light of our present knowledge, be conducted much on the same lines as one for consumptives: scrupulous cleanliness, pure air and sunlight, *strict attention to the destruction by fire or antiseptics of all substances containing bacilli*, especially the secretions of the mouth and nose and the discharges originating from tuberculous nodules. With abundant wholesome food, comfortable surroundings, distraction, and constant professional care, the lives of these victims could be made bearable; the fetters which sanitary rulings impose upon them would hardly be felt, and many would be returned to their homes.

[At the Leper Hospital of Maracaibo (Venezuela), in charge of Dr. Flores, a very laudable effort, sustained by the government and private initiative, to render the life of these unfortunates bearable, has been made. The success met with is thus described by our faithful consul in that city, Hon. E. H. Plumacher, who has repeatedly visited the sufferers and inquired into their general welfare:—

"The interior arrangements of the island are excellent. Capacious cisterns insure a supply of fresh water, and the diet is wholesome and abundant, the cost of the maintenance and treatment of each person amounting monthly to about thirteen dollars in American money. A comfortable building has been erected for the use of the employees, while for the patients a large edifice, built of concrete, forming a parallelogram with a courtyard in the centre, is divided into separate apartments, plainly, but sufficiently furnished. A neat chapel has been recently built, where religious service is held every Sunday. A pleasant feature is the establishment of cottages with grounds, in which reside those patients whose means permit of it. Land is given free to anyone who is able to erect a dwelling, and, as there are many who possess an income, little homesteads are soon formed.

"It was at first a mooted point as to whether marriages should be permitted among patients, but the question was de-

cided affirmatively, and several weddings took place. For years the theory of sterility was not contradicted by experience, and seemed about to be definitely settled, when two births occurred on the island, the parents in each case being lepers. I would be inclined to ask whether a mistake had not been made in the diagnosis of one or the other of the parents, confounding with true leprosy some other physical taint.

"With the establishment of matrimonial relations and the system of separate cottages for those who desire them, the island is beginning to assume the aspect of a rural municipality. Its extent is little more than a mile square, with good soil, of which advantage has been taken by the well-to-do patients for the cultivation of various products and the breeding of goats. The territory has been artificially stocked with game, which is now becoming abundant, and nothing seems to have been omitted to secure the comfort and welfare of the unfortunates. A library is at their constant disposal, and occasional musical entertainments are furnished by the Junta, whose efforts seem directed to the establishment of a *veritable home for the patients, where they may, as far as possible, forget their afflictions and pass their lives in cheerfulness.* Weekly visits of relatives and friends are allowed, which are looked forward to with eager anticipation, and the discipline generally is mild and judicious." C. E. DE M. SAJOUS.]

As to the immigration of lepers into the country, Dr. Bracken, of Minneapolis, basing his opinion upon a study of the Minnesota colony, suggests that the family history of all immigrants from a country where leprosy prevails should be secured before they are allowed to embark for America, no member of a leprous family being permitted to land upon our shores. This procedure would doubtless prove effective were it properly carried out; but, as recently shown by Hansen, in answer to Ashmead, who recommends the same measure, the symptomatology of the disease in its early stages and the necessity of examining the entire body of each passenger would defeat any attempt in this direction from the start.

The conditions antagonistic to the spread of leprosy in Minnesota are also opposed to sterility, as borne out by the families of several of the Minnesota lepers. Dr. Bracken believes it quite possible for leprosy to die out in certain favored sections of the country, such as Minnesota, without segregation, provided the importation of lepers is discontinued; but he contends that segregation should, nevertheless, be insisted upon in all cases.

Treatment.—If, as is now believed by Morrow, Hansen, Sticker, and others, "the vehicles of the virus through which contagion is affected in the vast majority of cases are the secretions of the mouth and nose," while "the port of entrance is the mucous membrane of the respiratory and intestinal tract with secondary infection through the blood or lymphatic system" (Morrow), attention to the nasal cavities, the mouth, and throat is of primary importance.

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Attention drawn to the importance of the nasal treatment, not only on account of the patient himself, but also in order to prevent the spread of the disease. Sticker (Münch. med. Woch., Nos. 39 and 40, '97).

The normal secretions of the nasal cavities are alkaline and of a higher specific gravity than water; hence, the use of the latter as detergent is painful and irritating to the mucous membrane. Any liquid used for this purpose should at least possess the alkalinity and specific gravity represented by 1 drachm of common salt to 1 pint of water. As a wash, the following mixture can be confidently recommended after extensive trial in disorders of the upper respiratory tract:—

℞ Borate of sodium,
Bicarbonate of sodium, of each, ½ drachm.
Fluid extract of Canadian pine, 1 drachm.
Glycerin, 2 drachms.
Water, 1 pint.—M.

This may be used with an atomizer producing a coarse spray night and morning, the cavities being thoroughly drenched. In large colonies under municipal management borax and bicarbonate of sodium, equal parts, may be procured in bulk and dealt out to patients with instructions to use 1 teaspoonful of the powder to a pint of lukewarm water. An economical way is to inhale the solution from the hand, using the latter as scoop. When ulceration is present, the local treatment for syphilitic rhinitis (*q. v.*) is indicated. The secretions, as already stated, should be destroyed, and the use of spit-cups rigidly enforced.

Segregation where lepers have previously lived without resorting to such precautions should be avoided.

Cleanliness of the surface should be carried to its maximum possibility compatible with the patient's strength. As a curative measure, Baelz, of Tokio, recommended 3 to 5 strong mineral baths at 45° to 53° C. a day for a period of about one month. His results were excellent. Sea-bathing was extensively used, and with marked advantage, during the early part of the century. At first warm sea-water baths were given, until all "scaly incrustations" were removed; after this "a cure was soon obtained, especially in young persons, by bathing in the open sea" (Willan).

Among the internal remedies recommended by dermatologists, chaulmugra-oil (see description in volume ii) may be said to hold the first place. The results obtained from its use have been varied, but, assisted by the prophylactic measures outlined above, its usefulness will probably be vastly increased. It has been administered in doses of from 10 to 200 drops. By beginning with small doses and gradually increasing the quantity given, the gastric disorders occasionally following its use may generally be avoided or at least retarded until active benefit is procured. It is borne more easily by lepers than by healthy subjects, and its use can be continued years, if need be. Many cases have been reported in which permanent cure had been obtained.

Tonics may be given at the same time. These agents, especially arsenic and strychnia, are of practical importance by tending to overcome the general adynamia.

> Experiments upon 18 patients as to value of chaulmugra-oil show increase of perspiration, decrease of tubercles, improved appetite and sense of well-being, increase of sensation and increased suppleness of skin, and lessening of pains in the joints. The oil was not administered in capsules, but drunk pure. The dose used was ½ to 1 drachm daily. Creolin used with excellent results, as a palliative and topical remedy. Beaven Rake ("Annual Report on Leprosy and the Trinidad Leper Asylum," '90).

Gurjun-oil, obtained from the *Dipterocarpus lævis*, a tree growing in eastern India, has also been considerably used, with varying results. It is given internally in capsules or in emulsion with lime-water, the dose of oil varying from 1 to 3 drachms. It is especially indicated in the anæsthetic form. The same solution is also applied over leprous sores as a dressing. Better results have been obtained by Phillippo, by the use of the latter externally and chaulmugra-oil internally.

Ichthyol has been strongly recommended by Unna, who gives about 10

grains a day in divided doses. Ichthyol-soap or the pure drug may also be employed locally. Pyrogallic acid and chrysarobin have also been recommended by Unna.

Cure of a Brazilian leper by Unna's method. Both legs and feet were rubbed with a 10-per-cent. pyrogallic-acid ointment, and the rest of the body with a 10-per-cent. chrysarobin ointment, twice daily. The face was covered with a strong creasote plaster-mull once a day, the jaws, however, being painted with zinc gelatin. Later, the larger tubercles were cut out and the patient given ichthyol internally. The patient recovered by the end of two or three months. Dreckmann (Berliner klin. Woch., Apr. 29, '89).

Crocker has recently used corrosive sublimate hypodermically. A Pravaz syringeful of the solution, varying in strength according to age, is injected into the buttock once a week. Europhen, thyroid substance, salicylic acid, and airol may also be mentioned among the remedies meriting a trial.

[Speaking of the use of mercury in leprosy, it seems to me—judging from experience acquired in the treatment of tuberculosis—that tonic doses of calomel ($^1/_{30}$ grain three times a day) should prove advantageous. (See MERCURY, PHYSIOLOGICAL ACTION.) They distinctly increase the number of red blood-corpuscles and stimulate nutrition. C. E. DE M. SAJOUS.]

Europhen successful when given a long time every day or every other day subcutaneously:—

℞ Europhen, $7\,^1/_2$ grains.
Oil of sweet almonds, $2\,^1/_2$ drachms.

Filtered and sterilized during twenty-four hours. Goldschmidt (Revue de Thér. Médico-Chir., Jan. 15, '95).

Literature of '96-'97-'98.

Two cases of leprosy treated by the thyroid-gland substance in both of which there was considerable improvement in the local lesions and general condition. C. B. Maitland (Lancet, Oct. 31, '96).

The following method is recommended:—

1. Local treatment with a 20-per-cent. salicylic-acid salve. This is applied over the diseased spots after having been rubbed with pumice-stone.

2. Administration of large doses of oleum gynocardiæ, $3\,^3/_4$ drachms.

3. Strong mineral-baths, 45° to 53° C., from 3 to 5 baths a day for a period of about one month. E. Baelz (Berliner klin. Woch., vol. xxxv, Nos. 46, 47).

In leprosy inunction and injections of airol (bismuth oxy-iodogallate) used. The inunctions are of 10-per-cent. solutions of the drug in vaselin, which give also the beneficial results from massage. For injections into the leproma the following formula is employed: Aristol, 5; glycerin, 35; distilled water, 10. The inunction is performed over the whole body at night; the next morning the patient takes a warm bath, and during the day the plaques and tubercles are injected. For the nose and throat the powder is insufflated, or, in case this is not well borne, the parts are painted with the ointment. The drug is undoubtedly absorbed and enters the blood as iodine, bismuth, and gallic acid, in a nascent state. During the early days of its administration by subcutaneous injection there appear dyspnœa, feeble heart-action, and reversed gastric peristalsis. Later appears a gray line at the junction of the gums with the teeth, which is attributable to the bismuth, while the other symptoms are caused by the gallic acid. Domenico Fornara (Therap. Woch., No. 12, S. 71, '97).

The therapeutic qualities of the sinu-tree (the *Excoccori agallocha*) should be investigated scientifically. This plant, when cut, exudes a thick, milk-white juice that is mildly irritating. Its action may either be to produce a reactive inflammation in the skin or to kill the lepra bacilli. L. Lewin (Deut. med. Woch., May 26, '98).

Tuberculous nodules may be destroyed by galvanocautery or thermocautery followed by local antiseptic lotions. If this procedure is objected to, their absorption may sometimes be obtained by local ap-

plications of iodine or mercurial ointment. Besnier uses with success in tuberculous cases a form of treatment combining several measures.

> Internal treatment (chaulmugra-oil, up to 300 drops; salol, up to 5 grammes daily) perseveringly administered. Each tubercle is cauterized interstitially by means of single or multiple points, or by electrocaustic bars when the surfaces to be destroyed are large. After cauterization should follow daily spraying with weak carbolic-acid water and dressing with sublimate or iodoform gauze, together with the management of cicatrization by means of nitrate-of-silver or zinc pencils. The same galvanocaustic application should be made to all affected points of the mucous membranes of the lips, nose, mouth, tongue, and pharynx. By their means it is quite easy to check and destroy the leprous foci so common in all these parts, and the results obtained are very remarkable. E. Besnier (Univ. Med. Mag.; "Pictorial Atlas of Skin Dis.," etc., Part IV, '96).

In a case successfully treated by Besnier in the manner just outlined, the patient, unknown to his physician, had also taken for a period of three years chlorate of potassium, 15 grains three times a day. Interesting in this connection is the following observation by Carreau, and the results obtained by Dyer with Calmette's antivenine.

> In a leper who was bitten by a rattlesnake a manifest diminution of the leprous tubercles took place before death, twenty-four hours after the bite. Recognizing the fact that the acknowledged result of inoculation of serpent-poison was to produce a condition of methæmoglobinæmia, heavy doses of potassium chlorate were tried in several cases of leprosy. From 150 to 300 grains of the drug were given daily for three days, producing grave symptoms of poisoning therewith, but after the disappearance of these symptoms the leprous tubercles almost entirely disappeared, leaving the skin soft and wrinkled. Carreau (Provincial Med. Jour., Mar. 1, '93).

The antivenomous serum of Calmette, of Lille, was employed by Dr. I. Dyer, of New Orleans, in the treatment of lepers, with promising results. It was injected under the skin with a Pravaz antitoxin syringe. The dose varied from 15 minims to 2 $^1/_2$ drachms. The injections were made every second day at first, subsequently every day. The parts of the body selected for injections were in the gluteal muscles and the skin in this region, the interscapular spaces, and, exceptionally, the leprous lesions themselves.

In four out of the five cases in which this procedure was resorted to marked improvement was obtained.

Serum-therapy has been tried by Carasquilla in one hundred cases with "good results," but the method has not, as yet, received sufficient trial to merit more than a mention. The same may be said of Merck's serum, tubercle-juice, and Coley's erysipelas toxins recently tried.

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> Horses immunized with blood-serum from lepers by injecting 15 to 60 cubic centimetres every ten days on three occasions, and ten days after the third injection the serum is taken. The serum, taken with great care, is then employed as follows: In a leper from whom blood to the amount of 150 to 250 cubic centimetres has been drawn, 1 to 5 cubic centimetres of horse's serum is injected after five days; a second injection is made three or four days later, according to the degree of reaction, then a third and a fourth; in some subjects reaction does not take place till after this period. The reaction manifests itself by fever, circulatory disturbances, changes in the secretions, etc. After some days the leprous lesions undergo somewhat rapid modification; the tubercles desquamate and shrink, the ulcerations become vegetating and cicatrize. The disturbances of sensibility are lessened, and, when the lesions

are not too far advanced, improvement takes place rapidly, and to an astonishing degree. One hundred cases treated by this method with good results. Carasquilla (Brit. Med. Jour.; Correio Med. de Lisboa, xxv, 122, 124, '96).

Case of maculo-tubercular leprosy treated with Carasquilla's serum.

Between February 7 and June 9, '97, twenty-six injections of serum were made into the buttocks; 0.2 cubic centimetre was first used, and this was increased up to 3 1/4 cubic centimetres. The injections were given at first twice and then once a week, and later there were at least two pauses of fourteen days. A local reaction occurred, most marked on the evening of the day of injection, and disappeared in a few days. Usually there were no unpleasant general symptoms.

Redness and swelling, with subsequent absorption, occurred in the leprous nodules, and there was considerable diminution in the infiltration of the tissues. A new growth of hair appeared on the extensive patches of alopecia upon the head. Leprous ulcers in the mouth healed. Patient's condition underwent, in every way, a marked improvement. During the four months after the injections there was some tendency to relapse, but these relapses were much milder than formerly. The results obtained were much better than under any other treatment. Buzzi (Brit. Med. Jour.; Deut. med. Woch., Oct. 14, '97).

Merck's serum was employed about six months. The first patient received, in all, eighteen injections, and the other twenty, and in addition to these, each was given the serum on three occasions by the mouth. The injections were made into the abdominal wall midway between the anterior superior iliac spine and the linea alba. A diphtheria-antitoxin syringe was employed. The total amount of serum injected was, in the first case, 4 ounces and in the second 5 ounces. The initial dose was 1/2 drachm, and the quantity was gradually increased until 2 1/4 drachms were injected at once. Decided improvement took place in both patients under the treatment. Amelioration persisted to the time at which the paper was written, namely: two and a half months after the cessation of treatment. A. Grünfeld (Derm. Zeit., B. 5, H. 3, '98).

Laverde obtained a fluid by crushing leprous tubercles, and this, after mixing it with sterilized water, he injected. The patients treated in this manner improved. M. Hallopeau (Brit. Med. Jour., Jan. 22, '98).

Four cases of leprosy subjected to treatment with the toxins of erysipelas. The initial dose was one minim of Coley's preparation of the toxins of erysipelas and of the bacillus prodigiosus, and this was gradually increased until near the close of the experiment in each case a dose of 22 minims was reached.

Conclusions reached are: (1) injections of the toxins of erysipelas have no effect on the course of leprosy, and (2) the system may tolerate large and continued injections if the dose is gradually increased. Henry Dwight Chapin (Phila. Med. Jour., Dec. 31, '98).

Beaven Rake, of Trinidad, has employed nerve-stretching. He found that the great sciatic was the most satisfactory nerve to stretch, being near the spinal ganglion, while it commands the supply of the whole leg and foot and the back of the thigh. The chief indications for the operation are perforating ulcer; some cases of necrosis; pain, whether associated with the perforating ulcer or with peripheral neuritis. More or less relief was given in one-half the one hundred cases operated upon.

For perforating ulcer of the foot occurring in leprosy, the ulcer is slit up by perforating the foot through the bottom of the ulcer from sole to dorsum, and then bringing out the bistoury between the toes. The wound is then stuffed with lint and allowed to heal up from the bottom by granulation. Beaven Rake ("Annual Report on Leprosy and the Trinidad Leper Asylum," '90).

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LEPTOMENINGITIS. See MENINGITIS.

LEUCORRHŒA. See UTERUS and VAGINA.

LEUKÆMIA.

Definition.—Leukæmia is a disease characterized by a marked excess of lymphatic tissue in the body, by a peculiar excess of circulating white corpuscles, and wide-spread and varied symptoms of toxæmia, with the frequent presence of mechanical symptoms of pressure.

Varieties.—There are three types of the disease, considered from both the pathological and clinical points of view: myelogenous, or leucocytic; lymphatic, or lymphocytic; and mixed leukæmia. The myelogenous and lymphatic types are chronic in their course. The mixed, or myelolymphatic, type is but rarely chronic, is usually acute, and comprises the special group of acute leukæmia.

Symptoms.—SYMPTOMS OF CHRONIC LEUKÆMIA.—The onset of chronic leukæmia is usually gradual. The symptoms are best summarized by systems.

The skin may rarely appear normal in color; in some cases it is very white; in most cases it is of a dull-yellow hue. Petechiæ, accidental eruptions, and areas of pigmentation or of loss of pigment are common. There is a sudoral type. Pruritus and paræsthesiæ are often noted. Œdema may occur, of four types: cardiac, anæmic, due to venous compression, and the peculiar form due to obstruction of the lymphatic channels.

Stomatitis and tonsillitis are very common, and may pass to ulceration, from whence hæmorrhage is apt to occur. Anorexia or perversion of appetite is seen in most cases. Vomiting is frequent; distress after meals, regurgitations, and eructations are almost constant. Diarrhœa is seen oftener than constipation, and in the cases with ulceration is persistent. Hæmorrhoids are not uncommon. Abdominal tenderness is often noted. The enlargement of the liver can be usually demonstrated; it is hard and smooth and may be tender. Ascites is uncommon. Jaundice is sometimes seen.

Rapid cardiac action is the rule. The pulse is full and of low tension; the capillary pulse is often present. The heart is rarely enlarged, but may be displaced by the spleen, liver, or mediastinal gland. The first sound often lacks the full muscular note. Systolic hæmic murmurs are common at the base and at the apex, while the venous hum in the neck is still more frequent.

> Case of leukæmia acutissima complicated with ulcerative endocarditis of the aortic valves, permitting regurgitation. The most striking phenomenon in the case was a centripetal venous pulse, plainly visible in the veins of the back of the hand, and disappearing on pressure upon the distal portion of the vein. Senator (Berliner klin. Woch., Jan. 27, '90).

Hæmorrhage into the skin and from the mucosæ are frequent, and may be spontaneous or induced by slight injury.

> Case of leukæmia in which hæmatoma suddenly developed in the right axilla, and extended downward to the sixth rib and from the nipple to the vertebral groove. Hale White (Lancet, June 9, '88).
>
> Case of leukæmia in which there was hæmorrhage from the bowels, as well as gingival hæmorrhage from the neighborhood of a carious tooth. Potain (Gaz. des Hôp., May 17, '88).
>
> Case of leukæmia in which fatal hæmorrhage from the bladder followed the passage of a catheter. Sheawin (Australasian Med. Gaz., Oct., '88).
>
> Case of acute leukæmia in which there was an attack of hæmoglobinæmia, hæmoglobinuria, and icterus, with fever and gastric disorders. The patient slowly recovered, but, after several months, succumbed in a second attack. Englehardt

(St. Petersburger med. Woch., May 2, '92).

A slight polyuria is often seen. The urine often contains an excess of urobilin. Albumin does not usually indicate nephritis. Albumoses may be found. A few leucocytes and hyaline casts are often to be found in the sediment. Some cases have frequent hæmaturia.

A fatal case of medullary leukæmia in a girl, 14 years old, the most striking post-mortem change being a diffuse leukæmic infiltration of the kidneys. Fränkel (Deut. med.-Zeit., Nov. 13, '90).

Priapism is an occasional symptom, due to infiltration of the corpora cavernosa. Leukæmia does not produce impotency. The menstrual function is usually deranged, and there is a tendency to much bleeding.

Case of leukæmia in which there was priapism with cessation of sexual excitement. The autopsy showed that the corpora cavernosa had become transformed into homogeneous connective tissue. Kast (Zeit. f. klin. Med., B. 8, H. 1, 2, '95).

Dyspnœa is almost constant and does not depend entirely on the anæmia, but is, in part, toxic. Œdema of the glottis or of the lungs may occur. Laryngeal ulcerations may produce grave danger, as may mediastinal or cervical pressure. Pleural effusion is rare. Epistaxis is common.

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Leukæmia changes in the larynx and trachea usually consist of numerous small nodules in the mucous membrane of the larynx and respiratory mucous membranes, or less frequently slight diffuse infiltrations. Ebstein (Wiener klin. Woch., s. 462, '96).

Case of leukæmic infiltration of the larynx. At the autopsy there was found perichondritis of the arytenoid cartilage in addition to the leukæmic infiltration. The periosteum in the right half of the larynx was evidently partly infiltrated by the leukæmic and partly by a simple inflammatory process. In the left half the infiltration was purely leukæmic. Mager (Wiener klin. Woch., No. 26, '96).

Changes in the larynx and in the trachea in cases of leukæmia. Case of a boy, aged 13 years, who had attacks of severe dyspnœa, with croupy cough. Laryngoscopical inspection revealed great thickening of the ventricular bands, and infiltration of the whole upper portion of the larynx. The child died with severe dyspnœa, aphonia, and bleeding from the mouth and nose. On post-mortem examination it was found that the infiltration of the larynx and bands was due to a dense collection of lymphocytes in the submucous tissue. The capillaries, also, were distended with lymphocytes, and these cells were especially abundant in the interglandular spaces. The submucous tissue in the trachea was affected in the same way. Otto Barnick (Münch. med. Woch., Apr. 19, '98).

The temperature is rarely normal for any length of time, a low irregular fever being seen at some period in most cases. Chills rarely occur, but may be without significance.

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Case of leukæmia under observation for three and a half months; there was daily rise of temperature followed by a gradual fall during the whole period. Von Hajek (Wiener klin. Woch., May 20, '97).

Exophthalmos may be produced by post-orbital collections. Leukæmic retinitis occurs in many cases, often accompanied by retinal hæmorrhages; it may cause no symptoms, or may produce amaurosis. Dimness of vision may be present without retinal lesions. Tinnitus aurium and vertigo are common; deafness may be rarely due to hæmorrhage into the internal ear.

Three autopsies in which it was determined that exudations and hæmorrhages

in the middle and internal ears were the cause of ear disease in leukæmia. Lannois (L'Union Méd., Feb. 16, '91).

Case of leukæmia in which sudden vertiginous attacks simulating Ménière's disease occurred. Subsequent anatomical examination disclosed a fibrinous collection in the utricle and saccule of the vestibule, with here and there more decided evidences of hæmorrhage. Lannois (Lyon Méd., Jan. 3, '92).

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Aural lesions appeared in 10 male and 5 female patients suffering from leukæmia. The aural affection took the form of more or less pronounced deafness, usually tending to rapid aggravation, and accompanied by tinnitus, and often vertigo. In a certain number of instances these symptoms constituted Ménière's triad. The anatomical lesions consisted in the accumulation of leucocytes, and the occurrence of hæmorrhages both in the medullary spaces of the petrous bone and other parts of the auditory apparatus, and particularly in the internal ear. Schwabach (Zeit. f. Ohren., '97).

Case of leukæmia presenting a peculiar affection of the eyelids, which at first had the aspect of œdema, but on closer examination proved to be small lymphatic tumors which were not adherent to the skin. Litten (Med. Bull., Mar., '97).

Case of leukæmia complicated by hæmorrhage into the anterior chamber of the right eye. Sorger (Münch. med. Woch., Aug. 30, '98).

Headache, insomnia, neuralgic pains, and depression are almost constant. Delirium may occur, toxic in origin; coma, when present, is usually due to intracranial tumor or hæmorrhage. Peripheral neuritis is uncommon.

Case of leukæmic bulbar paralysis. Kast (Zeits. f. klin. Med., B. 8, H. 12, '95).

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Two cases of disease of the spinal cord due to leukæmia. In the first microscopical examination of the cord revealed small myelitic foci, or, more strictly speaking, foci of acute or subacute nerve-degeneration, scattered through the white substance from the upper lumbar region to the medulla oblongata. Some of these degenerated points were large enough to be seen by the naked eye, and all stages of degeneration were to be observed, from a simple puffed-up appearance of the myelin sheath and swelling of the axis cylinder to segmentation, breaking up, and disappearance of the nerve-fibres, with compensatory hypertrophy of the neuroglia. Changes in the vessels, hæmorrhages, cellular infiltration, and extravasation of leucocytes were entirely wanting, and the gray matter throughout, together with the nerve-roots, were absolutely normal.

In the second case microscopical examination of the spinal cord revealed lesions identical in character, size, and distribution with those of the first case, the gray matter, nerve-roots and vessels being intact. Nonne (Deutsche Zeit. f. Nerv., Apr. 30, '97).

The spleen in myelogenous leukæmia may reach to the pelvis below and touch the liver to the right. It is hard and smooth; it may pulsate, give a friction-rub, or, on auscultation, a bruit. Splenic pain and distress are quite constant. In lymphatic leukæmia the spleen is less prominent. In all cases the enlargement is subject to fluctuations.

The lymphatic glands are inconstantly enlarged in myelogenous, but constantly in lymphatic, leukæmia. They are not hard, often tender, and usually painful. In the axillary, femoral, inguinal, and sacral regions they may press on veins, causing œdema and cyanosis, and by pressure on nerve-trunks produce great pain and even paralysis. The cervical glands especially tend to enlarge, they limit the cephalic movements, and may press upon the veins. Enlargement of the glands at the base of the tongue and of the tonsils may produce dysphagia. Enlargement of the thoracic glands may produce aphonia, bronchial or tracheal

stenosis, pressure on the superior vena cava or its bronchus, tachycardia, dysphagia, and cardiac dislocation. On percussion the area of dullness is usually easily demonstrable, and an actual protrusion of the mass is occasionally observed. Enlargement of the retroperitoneal glands may produce a large retroperitoneal tumor, with dislocation of the viscera, and perhaps œdema of the legs.

Method suggested to determine enlargement of the thoracic glands: The patient is placed before the observer, the fingers thrust behind the sternum, and then the patient's head rotated. In this way the thoracic glands may occasionally be felt. Enlarged bronchial glands sometimes push the arch of the aorta up and make it palpable behind the sternum. There may be, in addition, a systolic murmur from pressure on the aorta. Enlarged tonsils and lymphoid masses on the back of the tongue may be observed and intestinal involvement is proclaimed by intractable diarrhœa. Jaccoud (La Sem. Méd., Mar. 11, '91).

Twenty-eight cases of leukæmia analyzed: In 12 cases the blood was of Virchow's lienal type, in 4 of lymphatic, and in 12 of mixed type. The spleen was enlarged in all, the liver considerably so in 10, and in 10 there was polyadenitis. In 4 the mesenteric glands only were enlarged, in 4 the cervical and thymus, in 2 the mammary, and in 2 the axillary glands. Four cases occurred in the first year of life and 3 in the seventh decade. Weber (St. Petersburger med. Woch., Feb. 12, '92).

Pain in and tenderness over the bones exists in some cases of myelogenous leukæmia. Its absence signifies nothing.

Symptoms of Acute Leukæmia.—Acute leukæmia presents the picture of an acute infection. There is an irregular fever, often high, and chills are frequent. Some of the lymphatic glands become acutely enlarged, but this often subsides: the spleen is only moderately enlarged. Hæmorrhages are marked symptoms, from the gums, nostrils, from the stomach and rectum, and into the skin; they persist for days, and produce a distinctive picture. Ulcerations in the mouth are almost constant, and there is often a peculiar fœtor to the breath. Diarrhœa may be present, and intestinal ulceration is common. Vomiting is frequently noted. The pulse is usually very rapid, and dyspnœa is marked.

Case of acute leukæmia in a child of 10 years, in which, after a few days of malaise, hæmaturia, purpura, epistaxis, enlargement of the spleen, and, finally, hemiplegia rapidly ensued, and led to a fatal termination in four and a half days. The ratio of white to red corpuscles was 1 to 1 1/4. At autopsy the spleen and thymus were enlarged and various purpuric lesions were discovered. Guttmann (Berliner klin. Woch., Nov. 29, '91).

Case of acute leukæmia in a lad of 8 years. The clinical picture was that of purpura hæmorrhagica, and post-mortem there was found a pure lineal form of leukæmia. The duration was fourteen days. Twenty-seven cases of acute leukæmia collected. Eichhorst (Virchow's Archiv, B. 130, H. 3, '93).

Case of leukæmia associated with rickets in a child 1 year old, with glandular enlargement, swelling of the spleen and liver, and purpura. The blood-count showed 2,900,000 red corpuscles and 48,000 leucocytes. There were numerous nucleated red corpuscles and poikilocytes. Karyokinesis was noted in some red corpuscles. Morse (Boston Med. and Surg. Jour., Aug. 9, '94).

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A characteristic of acute leukæmia is the hæmorrhagic diathesis which is associated with swelling of the glands, spleen, and liver, and with peculiar blood-changes. Twelve cases personally seen in seven years. Many cases were mistaken for purpura hæmorrhagica until the blood-examination revealed their true nature. Typical heteroplastic leukæmic growths occur in the liver and spleen. The blood-changes are entirely characteristic. There is a remarkable increase of the mononuclear elements, which are of

the most varying sizes, but do not contain neutrophilic granules. A. Fraenkel (Deutsche med. Woch., July 1, '97).

A low delirium develops in most cases, passes into coma, and death occurs in from a few days to six weeks. No disease could possibly look more toxic.

Case in which epistaxis was the cause of death. Knipp (Maryland Med. Jour., Nov. 17, '88).

Minute hæmorrhages into the brain-substance were the cause of death in a case of leukæmia. Virchow (Deut. med.-Zeit., Jan. 30, '88).

Case of acute leukæmia in which the fatal event was precipitated by a puncture of the spleen, which was made for diagnostic purposes. A. Westphal (Münchener med. Woch., Jan. 7, '90).

Prognosis.—As just stated, the duration of acute leukæmia is from a few days to six weeks. The *duration* of *chronic leukæmia* varies from one to four years, though longer cases have been recorded. Death may be directly due to some of the symptoms, to exhaustion, or to intercurrent disease.

Case of acute leukæmia following influenza, which terminated in three days. Litten (Münchener med. Woch., Apr. 26, '92).

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In cases of leukæmia complicated by various septic processes, considerable improvement, at least in the leucocytosis, occurs as the infection develops. Marischler (Wien. klin. Woch., July 23, '96).

The prognosis as to life in leukæmia is hopeless; certain cases manifest remissions, but ultimately go on to a fatal issue. M. L. Goodkind (P. and S. Plexus, Apr., '98).

Case of acute leukæmia in a child 3 years old ending fatally thirteen days after the onset of illness. J. L. Morse (Arch. of Pediatrics, May, '98).

Diagnosis.—Chronic leukæmia in the active stage can always be diagnosed by a careful examination of the blood. In periods of quiescence of the disease, however, the blood may, for a time, not present the characteristic signs. It is the quality, rather than the quantity, of the leucocytes which characterizes leukæmia, though nearly all cases present a number of leucocytes never seen in the known forms of simple leucocytosis. In very rare instances the diagnosis from pseudo-leukæmia and sarcoma may be impossible. In children with secondary anæmiæ, enlarged spleens, marked oligocythæmia, pronounced leucocytosis, and some myelocythæmia, the diagnosis from leukæmia presents at times great difficulties. Acute leukæmia resembles the purpuræ on violent type, and the blood of all purpuric patients should be examined for leukæmia.

In acute leukæmia anatomical lesions may antedate the changes in the blood by a considerable time. Kast (Deut. med. Woch., Oct. 29, '91).

The varied character of the leucocytes regarded as of the greatest importance in distinguishing between leucocytosis and leukæmia. The myelocyte of Ehrlich may be a valuable diagnostic feature, but one which is frequently wanting. Troje (Deutsche med. Woch., Apr. 21, '94).

Blood of two cases of acute leukæmia examined. At a period of temporary improvement in one of the cases an ordinary examination of the blood would have failed to discover any leukæmia; whereas by Ehrlich's methods, the appreciable percentage of typical myelocytes found would at once arouse suspicion, even in the absence of leucocytosis. Thayer (Johns Hopkins Hosp. Bull., May, June, '91).

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Case of leukæmia in which the implication of the lymph-glands occurred with, what is usually considered, a typical myelosplenic blood-condition. It seems, therefore, that the blood-examination does not suffice to distinguish the types. Musser and Sailer (Trans. Assoc. Amer. Physicians, '96).

Case of lymphatic leukæmia in which the lymphocytes were found to contain sharply-circumscribed colorless bodies which showed amœboid movements even when cold. They were believed to be protozoa. Mannaberg (Centralb. f. innere Med., Apr. 25, '96).

There are only two forms of leukæmia: (*a*) Lymphæmia; the blood shows an increase of white cells of the type of lymphocytes. (*b*) Leukæmia proper; the blood presents an increase of white cells of the type of leucocytes in the wider sense—cells presenting all possible variations between the size of the nucleus and the size of the cell-body. The increase of the eosinophile-cells occurs generally only in leukæmia proper, exceptionally in lymphæmia. The characteristic feature of the leukæmic blood as against that in leucocytosis is the polymorphism of the white cells. Weiss (Hämatologische Untersuchungen, Vienna, '96).

Acute leukæmia may be diagnosed by the occurrence of a rapidly-increasing anæmia, with its accompanying symptoms, petechiæ over the body, or hæmorrhages from the mucous membranes, with enlargement of the lymph-glands, fever, and a moderately enlarged spleen and liver, accompanied by a decrease in the blood of the red cells and an increase of the white cells of mononuclear form. M. H. Fussell and A. E. Taylor (Phila. Med. Jour., Jan. 7, '99).

Etiology.—The etiology of the disease is probably concerned with a micro-organismal infection, the nature of which has not been determined; nor has the portal of infection been made out. For the numerous parasites of which a causal relation to leukæmia has been postulated no convincing pathogenicity has been demonstrated: they have, in all instances, been examples of accidental or terminal infection. The morbid changes and the symptoms almost indubitably suggest an infection.

The conditions which influence the prevalence of the disease are obscure. Two-thirds of the cases are in males. The majority of cases occur after puberty and before the age of fifty. Cases have been seen in the very old, however, and in infants and even in the fœtus.

Intra-uterine transmission of leukæmia from mother to child does not exist; but it still remains an open question whether or not an hereditary predisposition may be transmitted which may lead to the subsequent development of the disease. Saenger (Gaillard's Med. Jour., Sept., '90).

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Report of a case of pronounced leukæmia in an infant born of healthy parents, without syphilitic antecedents. On account of the verrucous endocarditis found at the necropsy, the nineteenth day after birth, the origin of the leukæmia ascribed to some infective process which affected the mother during her pregnancy, but which remained latent as far as she was concerned. Pollmann (Münch. med. Woch., No. 2, '98).

Case of œdema of the placenta and fœtal leukæmia. Siefart (Monats. f. Geburtsh. u. Gynäk., B. 8, H. 3, '98).

From different sources stress has been laid upon the possible predisposing influence of the infections, especially malaria, of pregnancy and lactation, of traumatism, and, in children, of rickets and syphilis.

Study of 600 cases of leukæmia suggesting that factors so far indicated in reality are but predisposing causes, the origin of disease being in the digestive tract,—*i.e.*, an autointoxication by toxic albuminoids. Vehsemeyer (Inter. klin. Rund., Nov. 25, '94).

Case of leukæmia following a blow in the abdomen. Churton (Brit. Med. Jour., Nov. 2, '95).

Case of leukæmia in a sailor of 42 years, in which the disease followed immediately after a severe abdominal contusion. Granzini (Riforma Med., Nos. 55, 56, '95).

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Autointoxication, particularly a toxæmia from the intestinal tract, occurring in neuropathic subjects affords favorable conditions for the development of leukæmia. M. L. Goodkind (P. and S. Plexus, Apr., '98).

Several cases have occurred in a family. There has been one published case which was apparently acquired by contagion. In a few instances pernicious anæmia and pseudoleukæmia have seemed to terminate in true leukæmia.

Pathology. — There are three main theories which aim to account for the lesions of leukæmia. Of the two earlier views, the Virchow-Neumann theory considered the excess of white corpuscles due to an abnormal hyperplasia of the hæmatopoietic tissues, and most of the adherents of this view have conceived this hyperplasia as analogous to that seen in malignant neoplasms.

The evidence points strongly to the correctness of Virchow's theory that leukæmia is a disease primarily of the blood-making organs, and that the increase of leucocytes takes place in these organs. The marrow-cells, or myelocytes, believed to be identical with the cells of the marrow, and not ordinary leucocytes increased in size by hyperplasia; strong belief shown in their value as elements indicative of a myelæmic form of leukæmia, though not absolutely diagnostic. H. F. Müller (Centralb. f. allg. Path. u. path. Anat., Nos. 13, 14, '94).

The Bilsiadecki-Löwit theory predicates a retardation in the evolution and prolongation of the life of the circulating leucocytes, the collections in the tissues being interpreted as the results of the deposition of the excess of the circulating leucocytes. Of these two the first undoubtedly contains the primary truth,—that there is a marked hyperplasia of some or of all the resident lymphatic tissues of the body, and that the circulatory conditions are dependent thereon. In recent years the neoplasmic conception has lost its hold upon investigators, who have gradually evolved the third theory: that leukæmia is an infection, and that the hyperplasia of the lymphatic tissues and the circulatory excess of white cells is the result of a specific stimulation and leucocytosis, analogous to those seen in the course of other infections. Our present knowledge of leukæmia, of the infections and the tissue-reactions to them, and of the leucocytoses strongly support this view. The primary lesions in leukæmia must be carefully separated from the secondary alterations.

Leukæmia believed to be a specific infectious disease. Westphal (Berliner klin. Woch., Oct. 7, '89).

A priori, the genesis of leukæmia is best accounted for by a deviation of nutrition due to a lesion of the great sympathetic or by the action of a micro-organism, and of the two hypotheses the parasitic personally preferred. Mayet (Lyon Méd., Apr. 1, '88).

A short, blunt bacillus found in the spleen of a person dead of leukæmia. It was not found in twelve spleens of other diseases. Fermi (Canadian Practitioner, Feb. 16, '91).

Leukæmia is due to a mitotic increase of a certain kind of leucocyte in a pathological manner as a result of the action of some cause as yet unknown. Hindenburg (Deutsches Archiv f. klin. Med., B. 54, S. 209).

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Case of acute lymphatic leukæmia with streptococcic infection. Patient first had a sharp attack of sore throat, with recurrence after a week, and then rapid enlargement of the glands of the neck, axilla, and groin. The spleen was enlarged. Leukæmia had not existed prior to the throat infection. J. B. Herrick (N. Y. Med. Rec., July 10, '97).

Myelogenous or Leucocytic Leukæmia.—By myelogenous or leucocytic

leukæmia we understand the type in which the hyperplasia affects the myelocytes of the marrow and the leucocytes derived from them. It is the common type. The essential change in the marrow is the so-called pyoid condition, a marked overgrowth of the myelocytes, which more or less completely replace the fatty marrow. Microscopically the tissue is chiefly composed of neutrophilic myelocytes, which in properly prepared preparations are seen to be in active reproduction and development into neutrophilic polymorphonuclear leucocytes. The eosinophilic myelocytes are also in actual excess, and mast-cells may often be seen in large numbers. The osteoplaxes are in excess, and are actively engaged in phagocytic function and contain erythrocytes and leucocytes. The lymphocytic nodes of the bone-marrow are not affected in the process of overgrowth.

The secondary lesions in the marrow consist, for the most part, of alterations in the erythrogenetic tissues. There is a marked toxic hæmolysis connected with the condition, and in the attempt to keep pace with the destruction of the red cells the red marrow undergoes a compensatory hypertrophy, it becomes splenified like the fœtal marrow, just as in pernicious anæmia. This red marrow may be universal, or may appear only in scattered areas; in some cases it is entirely absent. Microscopically the red marrow presents myriads of enucleated red cells engaged in active proliferation, the macroblasts being especially prominent. Hæmorrhage and infarction may be present, as may fatty degeneration and hyaline changes.

Case of more or less pure myelogenous leukæmia. The spleen weighed 10 ounces, but the lymph-glands were not at all enlarged. Beatty (Dublin Jour. of Med. Science, May, '91).

The marrow-changes are, as a rule, the first and the essential, though subsequently often overshadowed by the splenic and lymphatic manifestations. Boyd (Practitioner, Aug., '94).

The myelocytes are identical with marrow-cells, and are present in increased amount because of some abnormal activity in cellular proliferation in the marrow. Stanley (Birmingham Med. Review, Jan., '94).

Case of myelogenic leukæmia in which erythrocytes presented numerous mitoses. Pick (Berliner klin. Woch., No. 43, '94).

In acute leukæmia there are karyokinetic changes in leucocytes, besides great number of them. Marrow of long bones showing hyperplastic multiplication of medullary elements, that of ribs containing small number of nucleated red corpuscles. Possible indication that evolution of young lymph-cells into red corpuscles impeded. Askanazy (Virchow's Archiv, B. 137, H. 1, '95).

The alterations in the blood correspond to those in the marrow. The white cells number usually from 100,000 to 600,000 per cubic millimetre. Neutrophilic myelocytes constitute a large portion of the circulating white cells, sometimes more than half. Next in number are the neutrophilic polymorphonuclear leucocytes. Mononuclear eosinophiles (myelocytes) and polymorphonuclear eosinophiles are in most cases present in large numbers. The non-granulated large mononuclear cells are usually in excess. Mast-cells are seen in considerable numbers. Many of the cells of all the enumerated types present a marked polymorphism in size, shape, and appearance of nuclei; and in the number, size, and staining of the granules they vary greatly; this extreme degree of polymorphism is characteristic of leukæmia. Cellular degenerations often affect these leucocytes, karyolysis being more frequent than karyorrhexis. The lymphocytes are usually not increased in myelogenous leukæmia; if in excess it is to

a slight degree, dependent probably upon the anæmia, and the cells do not present the polymorphism and degenerations seen in the leukæmic corpuscles. Cell-division is rarely to be seen.

Case of spleno-myelogenous leukæmia, not remarkable except for the blood-count at the first examination. There were 260,000 leucocytes, 880,000 red corpuscles, and 30 per cent. of hæmoglobin. Brannan (Amer. Medico-Surg. Bull., May 15, '94).

In acute leukæmia there is increase of leucocytes and eosinophile cells. Micro-organisms in great number in blood and enlarged organs. Hintze (Deutsches Archiv f. klin. Med., B. 53, H. 3, 4, '95).

Special transparent polynuclear leucocytes also found, but in remarkably increased quantities, in case of leukæmia. Georgierski (Bolnitchnaja gaz. Botkina, No. 10, '95).

The red cells are in all cases reduced, little in some, extremely in others. As a general rule, poikilocytosis, microcytosis, and macrocytosis exist in degree corresponding to the oligocythæmia. Erythroblasts are very common in even mild cases of leukæmia with little oligocythæmia; normoblasts are the most frequent form noted, but microblasts and macroblasts may appear in large numbers. All the erythrocytic alterations seen in pernicious anæmia may be seen in leukæmia. The quantity of nucleated red cells seems, in a measure, due to the mechanical conditions in the marrow, but the mere presence of them is not a leukæmic sign, being simply the result of erythrogenetic overactivity's attempting to compensate for the hæmolysis.

Chemical changes of leukæmic blood are such as could be explained by the excess of leucocytes and the decrease of red corpuscles. Freund and Obermayer (Zeit. f. physiol. Chemie, Mar. 24, '91).

Attention called especially to the presence of large numbers of nucleated red corpuscles, and to free nuclei of such. The latter seemed to have been extruded from the cell. Indistinct evidence of mitosis was also a common feature of these nucleated red cells. McWeeney (Dublin Jour. Med. Science, July 14, '94).

Attention called to the process of filamentary budding of erythroblasts through the endothelial wall as a factor in the formation of red blood-cells. Observations made on leukæmic spleen. John Guitéras (Inter. Med. Mag., Dec., '95).

From the circulating blood the white corpuscles are deposited in the various tissues, and these collections constitute the most important secondary lesions of the disease. Probably mechanical deposition and emigration both play a rôle in the formation of the collections, and it is commonly believed that, once established, the collections can maintain by cellular division their own existence. The spleen is the organ most often affected. Tremendous numbers of the leukæmic cells are deposited in the spleen, causing most remarkable enlargement, as a result of which the capsule thickens and the fibrous trabeculæ hypertrophy; so that in the late stages the organ is very hard. The essential lymphocytic structures of the spleen take no part in the process of proliferation; on the contrary, they are very scarce. The enlargement of the spleen is further augmented by the exercise of its functions in connection with the hæmolysis constantly going on. It is clear that the spleen is only secondarily affected in myelogenous leukæmia, and the term "spleno-myelogenous" leukæmia, while serving to emphasize the splenic symptom, is not correct pathologically.

The liver is usually very much enlarged, due chiefly to the deposition of the circulating leukæmic cells. It is hard, smooth, light in color, and presents an excess of iron-pigment. The leukæ-

mic collections follow the vascular channels. The excess of free hæmoglobin, effected by the hæmolysis, imposes upon the liver an augmentation of its functions, which doubtless increases its enlargement. In a few cases signs of a return to fœtal hæmogenesis have been seen in the liver.

The intestinal tract is often the seat of large leukæmic depositions; the essential lymph-nodes of the submucosa, however, undergo no abnormal proliferation. The collections not infrequently necrose and ulcerate, the destruction being probably due to a mixed infection from the tract.

The skin may be the seat of depositions, which may ulcerate. Some of the cases of cutaneous multiple sarcomata are of this nature.

The kidneys usually present some infiltrations, which follow the vascular channels. Of the other organs of the body the pancreas, adrenal and thyroid bodies, the heart, the lungs, the upper respiratory tract and mouth (where ulcerations may occur), and the brain may present infiltrations which are usually slight in degree. Depositions within the lymph-glands are not uncommon in the mediastinum, in the retroperitoneal glands, and in the peripheral glands; pressure-effects are then frequently produced. Infiltrations into the spinal cord are very rare.

Hæmorrhages are quite frequent in myelogenous leukæmia. They may be in the skin as petechiæ, under the sera, from the mucosa, and into organs, especially the brain. The blood and tissues after death often contain the well-known Charcot-Leyden crystals; in rare instances they are present preformed in the blood.

Charcot-Leyden crystals in the blood of a leukæmic both before and after death, though especially after death. Ord and Copeland (Lancet, May 30, '91).

Charcot-Leyden crystals found in fluid drawn from the spleen during life. Westphal (Deutsches Archiv f. klin. Med., B. 47, H. 5, 6, '91).

Thromboses are not rare, most often in the veins. Fatty degenerations in the parenchymatous structures of the heart, liver, kidneys, pancreas, and in the alimentary epithelium are quite the rule. Hyaline changes are often seen in both varieties of muscle.

Lymphatic Leukæmia. — By *lymphatic* or *lymphocytic leukæmia* we understand the form of the disease in which the lymphocytic glands, nodes, and structures undergo the hyperplasia. The lymphocytic structures comprise the lymph-glands and spleen, the lymph-nodes of the bone-marrow, the tonsils and submucous nodes of the intestine, the subcutaneous lymph-nodes, and the scattered lymph-strands seen in all tissues, especially in the lung, liver, and kidneys. Commonly the hyperplasia affects the lymph-glands and the spleen; in rare instances it affects most notably the nodes in the skin (dermic leukæmia), in the intestine (intestinal leukæmia), or in the bone-marrow (osseous leukæmia, or lymphæmia).

The essential lesions consist in an abnormal hyperplasia of the glands or nodes, with the production of an excess of lymphocytes. The glands are much enlarged, soft in the early stages, but later hard from trabecular and capsular fibrosis. Hæmorrhages may occur into them. The spleen is usually moderately enlarged, and, as the changes in it are active, the term "spleno-lymphatic" is pathologically correct. A case of lymphatic leukæmia affecting primarily the spleen alone has never been demonstrated. The inguinal, axillary, subclavicular, and cervical glands are the

peripheral sites most often affected. The retroperitoneal and mediastinal glands may be enormously enlarged. In the intestinal type the submucous follicles are much enlarged. In the dermic form small lymph-nodes form multiple tumors beneath the skin. In both of these ulcerations may occur. In the osseous type the marrow presents pale areas resembling lymph-glands to the naked eye. Microscopically all these structures display active proliferation. The cells are polymorphous in type, and degenerations are common. The myelocytes are not involved in the hyperplasia, but as in any severe anæmia the marrow may be splenified.

The blood presents a lymphæmia or lymphocytosis. The number of white cells is much less than in the myelogenous type, rarely over 150,000 per cubic millimetre. The excess of cells is composed of lymphocytes, large and small, polymorphous in appearance, many presenting degenerations. The polymorphonuclear leucocytes, the non-granulated large mononuclear leucocytes, the eosinophiles, and the basophiles are present in normal or even subnormal numbers. Nucleated red cells are rare. The alterations in the number and quality of the red cells are much less than in myelogenous leukæmia.

The secondary lesions are less marked than in myelogenous leukæmia. The infiltrations are present in the liver, kidneys, pancreas, and to a small extent in the other tissues, but they do not produce the marked organic enlargements noted in the other variety. The pigmentary changes are less marked, corresponding to the lesser degree of hæmolysis. The fatty and other degenerations are likewise less marked,—as are the hæmorrhages.

Mixed Leukæmia.—By *mixed leukæmia* we understand the extensions of the hyperplasia to both the myelogenous and lymphocytic structures, and it has been well defined as an "autochthonous hyperplasia of the lymphatic tissues of the entire body," both lymphocytic and leucocytic. The hyperplasia is more marked in the lymphocytic than in the myelogenous structures. Nearly all the cases are acute in form.

The lymph-glands are not markedly enlarged, they are soft and often have an hæmorrhagic tinge. Upon section the germ-centers are seen in a state of most remarkable proliferation: there are infiltrations into the vessel-walls and thus a direct flooding of the circulation with the mother-cells of the germ-nests, while the small lymphocytes reach the circulation by the usual channel. The same hyperplasia of the distorted germ-nests is seen in the intestinal (where ulcerations are common), in the osseous lymph-nodes, and in the tonsils. The myelocytes are also engaged in abnormal proliferation, though less actively than are the lymphatic cells. Splenification of the marrow is not a marked condition.

The blood presents striking changes. The leucocytosis is not marked, rarely over 250,000 and often not over 50,000 per cubic millimetre. The larger majority of the cells are lymphocytes of large size, corresponding to the proliferating cells of the germ-nests. The lymphocytes are very polymorphous in appearance, and degenerations are commonly seen. The polymorphonuclear, eosinophilic, and basophilic cells are seldom increased, the polymorphonuclear cells are often decreased, and the eosinophiles may be almost absent. Myelocytes are not usually found in the circulating blood, despite the hyperplasia in the marrow. The red cells are more reduced than in chronic leukæmia. Nucleated

red cells are not, however, a special feature. The qualitative changes in the red cells are marked.

The secondary depositions in the tissues are not marked. This is due to the acuteness of the process. Nevertheless, they exist in most of the organs and tissues. The spleen is proportionately not more enlarged than the lymph-glands; it is usually very soft. The depositions in the tissues correspond to the cells in the blood. Hæmorrhages are very common into the glands and organs, from the mucosa, into the skin and sera; they are present in three-fourths of the cases. Fatty degenerations are not so marked as in more chronic cases, but hyaline changes and areas of focal necrosis are common.

The digestion of most cases of leukæmia is chemically and physiologically defective. The salivary juice seems little affected. The gastric juice, however, is commonly deficient in HCl, pepsin, and the curdling ferment. Motility is often reduced. The assimilation of food by such patients is usually notably below the normal.

The urine presents very important alterations. In most cases a marked increase in uric acid is found, often up to 2 to 3 grammes per diem. The alloxuric bodies are likewise somewhat increased. These conditions may produce stone. The performed and ethereal sulphates, the neutral sulphur, the phosphates, and calcium are eliminated in excess of the normal. Albumin is often present, usually not with casts. Acetone and diacetic acid may be present in periods of tissue-waste, while pathological urobilin and hæmatoporphyrinuria are usually demonstrable.

The tissue-changes in leukæmia are unusually active, the O input and CO_2 output are above the normal; there is, therefore, rather hyperoxidation than suboxidation. The parenchymatous degenerations are due to toxæmia.

Excretion of uric acid decidedly increased in three cases of leukæmia. The proportion between the quantity of nitrogen contained in the excreted uric acid and the total amount of nitrogen in the urine was also decidedly altered. Bohland and Schurz (Deutsche med.-Zeit., Nov. 10, '90).

Literature of '96-'97-'98.

In leukæmia in the cases where uric-acid excretion is normal or diminished, the alloxur bodies are increased, and their amount varies directly with the amount of leucocytes. Gumprecht (Cent. f. allg. Path. u. path. Anat., vol. vii, p. 820, '96).

Metabolism in acute and chronic leukæmia studied. Acute cases were characterized by excessive elimination of uric acid, great loss of nitrogen, and large amounts of urine, all increasing up to death; in the chronic cases there was an approximate nitrogen equilibrium, moderate quantity of uric acid, no antemortal increase. There is no parallelism between the number of leucocytes and quantity of alloxur bodies. Magnus-Levy (Virchow's Archiv, B. 152, H. 1, '98).

Treatment.—Rest, the best of care and hygienic surroundings, and a nutritious diet are the general indications. Arsenic is the best remedy, and should be given in ascending doses and for a long period of time. If it disturbs the stomach or provokes diarrhœa, it should be given hypodermically.

Hypodermic injections of arsenic recommended in leukæmia. Fowler's solution is painful, but a solution of arsenite of soda 2 grains to the ounce in doses of $^1/_{25}$ to $^1/_2$ grain has been used with excellent effect. Rummo (Rif. Med., No. 1894, '94).

Bone-marrow has been used with some success, and, given with arsenic, it has seemed to heighten its action.

Literature of '96-'97-'98.

Case of splenic myelogenous leukæmia made worse by bone-marrow. C. E. Nammack (Med. Rec., Jan. 4, '96).

Extract of spleen is of no value. Iron is of value in the periods of apparent convalescence, but has no influence on the leukæmic progress.

Case of splenic anæmia successfully treated internally with small doses of perchloride of mercury. E. Mondigliano (La Pediatria, Apr., '93).

Case of a boy, 10 1/2 years old, with a considerably-enlarged spleen and a proportion of one white to ninety red corpuscles. The condition was cured by oxygen-inhalations. Kirnberger (Deut. med. Woch., No. 41, '83).

Two cases of leukæmia treated by inhalation of oxygen. One of which, a boy of 13, was cured; and the other, a man of 35, greatly improved, and apparently on the way to recovery. The improvement in each case dated from the commencement of the oxygen-inhalations. Da Costa and Hershey (Amer. Jour. of the Med. Sciences, Nov., '89).

Oxygen-inhalations employed in case of lymphatic leukæmia without success. The gas employed, however, was dilute, being one-third nitrogen, and of this mixture 28 quarts were inhaled daily; whereas, in the cases of Da Costa and Hershey, the oxygen was perfectly pure and given in much larger amount, the maximum dose being 105 quarts per diem. Kahler (Inter. klin. Rund., Aug. 11, '89).

Literature of '96-'97-'98-'99.

Carbonic-acid gas administered to two cases of leucocythæmia. Oxygen was administered simultaneously and galvanism was applied to the region of the spleen for five minutes before, as well as during, the sitting. In both cases, one in a boy, the other in a young woman, there was perceptible diminution in the size of the spleen. Ewart (Brit. Med. Jour., July 23, '98).

All treatment in acute leukæmia has thus far been useless. Every case has progressed to a fatal termination unmodified by the various forms of treatment employed. M. H. Fussell and A. E. Taylor (Phila. Med. Jour., Jan. 7, '99).

Local treatment over the spleen or enlarged glands, — blisters, cauterization, the local applications of iodine, cold douches, and electrical treatment may alleviate the symptoms to some extent. Excision of the spleen or of lymph-glands is contra-indicated both by theory and by unfortunate experience.

The various systemic disturbances—cough, anorexia, vomiting, diarrhœa, œdema, serous effusions, headache, insomnia, and neuralgia—demand appropriate treatment. In case of pressure upon large vascular trunks or nerve-trunks surgical interference may be indicated.

Alonzo Englebert Taylor,
Philadelphia.

LICORICE. — Licorice, or liquorice (glycyrrhiza, U. S. P.), is the root of *Glycyrrhiza glaba* (*Leguminosæ*), indigenous to Southern Europe, Syria, and Persia, and cultivated in several of the northern countries of Europe. The sweetest licorice comes from Italy. The root contains an amorphous, bitter-sweet glucoside, glycyrrhiza; a crystallizable principle, asparagin; resin, starch, albumin, liquin, lime and magnesium salts; and malic, phosphoric, and sulphuric acids. When glycyrrhiza is boiled with dilute acids it is resolved into sugar and a bitter brownish-yellow substance called glycyrrhetin. Glycyrrhiza treated with ammonia becomes ammoniated glycyrrhiza, which occurs in dark-brown or brownish-red, sweet scales, freely soluble in water or alcohol.

Preparations and Doses.—Glycyrrhiza (licorice-root), *ad libitum*.

Extractum glycyrrhizæ, 15 to 60 grains.

Trochesci ammonii chloridi, 1 to 2 troches.

Trochesci glycyrrhizæ et opii, 1 to 2 troches.

Extractum glycyrrhizæ fluidum, $^1/_2$ to 2 drachms.

Extractum glycyrrhizæ purum, $^1/_2$ to 2 drachms.

Mistura glycyrrhizæ composita, 2 to 6 drachms.

Glycyrrhizinum ammoniatum, 5 to 15 grains.

Pulvis glycyrrhizæ compositus, $^1/_2$ to 4 drachms.

Therapeutics. — The preparations of licorice are mostly used in affections of the air-passages and of the alimentary tract.

Diseases of the Respiratory Tract.—In bronchial catarrh a popular remedy is the compound mixture of licorice, or brown mixture, which contains 3 parts of pure extract of licorice, 12 parts of paregoric, 6 parts of wine of antimony, and 3 parts each of sweet spirit of nitre, gum arabic, and sugar, and 70 parts of water.

In the various forms of pharyngitis and laryngitis, with irritable cough, the troches of licorice and opium (Wistar's cough-lozenges, containing 2 grains of extract of licorice and $^1/_{20}$ grain of extract of opium, with anise-oil, gum, and sugar) are useful in allaying the irritability and the cough. The troches of ammonium chloride are similarly used in pharyngitis, laryngitis, and subacute bronchitis.

Constipation.—In the compound powder of licorice we have a valuable remedy for constipation. In contains 18 parts of senna, 16 parts of licorice, 8 parts of fennel, 8 parts of washed sulphur, and 50 parts of sugar. It is largely used as a laxative during pregnancy and after childbirth, and may be given to children, on account of its pleasant taste.

Pharmaceutical Uses. — Ammoniated glycyrrhiza is a useful agent to mask the bitter taste of quinine, being used in the proportion of two to one. The extract is used to conceal the taste of unpleasant remedies and to increase the cohesiveness of pills.

Powdered licorice-root is used to prevent pills from adhering to each other, and as a dusting-powder in pharmaceutical manipulations.

LIDS. See Palpebræ.

LIME. See Calcium.

LINUM.—Linum (linseed or flaxseed) is the dried ripe seed of *Linum usitatissimum*, the common flax: a plant of almost universal cultivation. The seeds are oval and flattened, and have sharp edges and somewhat pointed extremities. Externally they are brown and shining; internally they are yellowish white. They have no odor, but a mucilaginous taste. They contain a fixed oil, wax, resin, extractive, tannin, gum, mucilage, albumin, gluten, and salts. The fixed oil is found in the interior of the seed, and when expressed without the aid of heat is known as linseed-oil (oleum lini, U. S. P.). When ground, the seeds form a grayish meal, known as flaxseed-meal, ground linseed, or linseed-meal. When freely ground the meal is rich in oil and free from rancidity. The cake of linseed which remains after the oil is expressed is known as oil-cake, and when ground is known as cake-meal, which is not only poor in oil, but liable to be rancid. Cake-meal is unfit for use in medicine.

Preparations and Doses.—Linum (flaxseed).

Oleum lini (linseed-oil), $^1/_8$ to 8 drachms.

Linimentum calcis (carron-oil).

Therapeutics.—On account of its demulcent action upon mucous membranes, flaxseed is used in the treatment of bronchitis, gastritis, acute cystitis, and nephritis. It is usually given in the form of flaxseed-tea:—

Whole flaxseed, 3 drachms.

Extract of licorice, 30 grains.

Boiling water, 10 ounces.

Mix and stand in a warm place for three or four hours, and add a little lemon-juice, lemon-peel, and sugar to taste, and 1 to 2 drachms of gum arabic. If cough is present add some paregoric.

Ground flaxseed mixed with boiling water forms the well-known flaxseed poultice. It should be spread at least half an inch in thickness upon muslin or flannel, the surface covered with gauze or cheese-cloth, and applied as hot as can be borne. It should be covered with thin rubber cloth to retain the heat and moisture and be renewed as soon as it *begins* to cool or dry. If counter-irritant effect is desired, the surface may be sprinkled with dry mustard or a few drops of turpentine. These applications are useful in pneumonia or pleurisy (as jacket-poultice), peritonitis, abscess, boils, felons, inflamed glands, indolent ulcers, etc. Laudanum is a valuable addition to a poultice in painful affections.

Carron-oil (linimentum calcis) is an old and efficient application to exclude air from burns. The addition of 1 drachm of carbolic acid to the pint of carron-oil increased its efficiency and adds antiseptic action. Linseed-oil, given in doses of 1 to 2 ounces, is a laxative of especial value when hæmorrhoids are present; it has been used as a nutrient by Sherwell, of Brooklyn, in various cachectic conditions.

LIPOMA. See Tumors.

LIPS. See Oral Cavity.

LITHIUM.—Lithium is one of the alkali-metals, and is generally derived from lipidolite, a native silicate. It is also found in petalite, spodumene, triphylline, and a few other minerals, and occurs in minute quantities in some mineral springs (Buffalo, Farmville [Va.], and Londonderry [N. H.] lithia-waters). The metal is not used in medicine. Like other alkali-metals, it unites with oxygen, forming an oxide, which with the acids forms salts, and also directly chlorine and bromine, etc. Lithium carbonate occurs as a light, white powder with distinct alkaline reaction, and is soluble in 130 parts of water and in dilute acids. Lithium citrate occurs as a white, crystalline powder, with feeble alkaline taste and almost neutral reaction. It is soluble in $5\ ^1/_2$ parts of water and slightly soluble in alcohol. Lithium benzoate occurs as a light white powder or in shining sweet scales, and is soluble in 4 parts of water and 12 parts of alcohol. Lithium bromide occurs in white deliquescent, slightly-bitter granules, and is soluble in water and alcohol. Lithium salicylate occurs as a white deliquescent sweetish powder, is soluble in water and alcohol, and is decomposed by heat.

> It has been found advantageous to triturate the carbonate of lithium with bicarbonate of sodium or with sugar, in order to facilitate its solution in gaseous water. Carles (Jour. de Méd. de Bordeaux, p. 318, '90).

Preparations and Doses.

1. Carbonate (lithii carbonas), 3 to 15 grains.

   Citrate (lithii citras), 10 to 30 grains.

Effervescent citrate (lithii citras effervescens), 1 to 2 drachms.

2. Benzoate (lithii benzoas), 10 to 30 grains.

Bromide (lithii bromidum), 5 to 40 grains.

Salicylate (lithii salicylas), 10 to 30 grains.

[The preparations in the first groups act as lithium; those of the second group have the action of the acid or element forming them.]

Physiological Action.—Binet has shown that lithium salts give rise in animals to the following series of symptoms: Weakness, diarrhœa, nausea, dyspnœa, fall of temperature, convulsions, and death. The latter is attributed to depression and final arrest of the heart in diastole, coupled with an inhibitory influence upon the respiratory centres. The peripheral nervous system is paralyzed and muscular excitability is reduced.

The lithium salts probably have an important influence upon metabolism. They are promptly absorbed and eliminated with the urine, which is rendered alkaline. They have been shown capable of dissolving uric acid and the urates, and are therefore extensively used to counteract the so-called uric-acid diathesis.

> While all of the lithium salts possess diuretic properties, the most active in this respect is the citrate, which has the further advantages of great solubility and comparative freedom from disagreeable taste. The acetate is second in activity. Mendelsohn (Deut. med. Woch., Oct. 10, '95).

Therapeutics.—The preparations of lithium have held a high reputation for efficiency in the treatment of the uric-acid diathesis in its many phases. It has been claimed that they can dissolve uric-acid calculi in the urinary passages or in the bladder. Haig has called our attention, however, to the fact that, although lithia forms salts with uric acid in the test-tube, in the body it has a greater affinity for the acid sodium phosphate in the blood, and thus the uric acid is left uncombined.

Rheumatism and Gout.—The carbonate, citrate, and salicylate are used in the treatment of rheumatoid arthritis, gout, and subacute and chronic rheumatism. The carbonate is practically insoluble in water (1 to 130), and should be given in freshly-made pill or capsules. Citrate may be given in solution alone in Vichy water or combined with other remedies. Lithium citrate, 1 $^1/_2$ drachms dissolved in 2 ounces each of spirit of Mindererus and syrup of lemon, may be given in dessertspoonful doses every two or three hours in rheumatism or gout. Lithium salicylate is especially useful in subacute rheumatism, given in doses of 10 to 20 grains every three hours.

Cystitis and Gravel. — The lithia-salts are given in cystitis and gravel with great benefit. When there is an increased secretion of ropy mucus and the presence of alkaline urine, lithium benzoate is to be preferred, since it renders the urine more acid; when the urine is already too acid the carbonate or citrate is better.

Diabetes.—In diabetes, with gouty taint, the use of lithium carbonate or citrate in dose of 10 grains, combined with $^1/_{30}$ grain of sodium arsenite given three times daily, is often followed by remarkable results. (Hare.)

> In 4 cases of universal pruritus the best results have been obtained from the combined use of bicarbonate of sodium and carbonate of lithium, after all other known remedies had failed. C. Lange (Jour. of Cut. and Genito-Urin. Dis., Oct., '91).

Lithium bromide is employed for the effect of the bromine it contains. It may succeed in epilepsy after the failure of

the potassium or sodium bromides. Its hypnotic power is regarded by Weir Mitchell as superior to that of potassium bromide.

LITHOLAPAXY. See URETERS, BLADDER, AND PROSTATE.

LIVER AND GALL-BLADDER, DISEASES OF THE.

Diseases of the Liver.

Malformations.—Abnormalities in the form of the liver are not common. They may be either acquired or congenital.

1. **Corset-liver.**—The constant pressure of the lower ribs against the liver as a result of tight lacing or the wearing of a tight waist-band may produce a deep, transverse furrow on the right lobe from atrophy of the parenchyma. The furrow usually corresponds to the margin of the ribs, and may be so deep that the liver becomes divided into a large upper and a small, lower, part connected together by a narrow isthmus or band composed chiefly of fibrous tissue, the larger blood-vessels, and bile-ducts. The peritoneum in the groove is much thickened. The lower portion is usually rounded and may be freely movable as if hinged to the upper, and appear in the abdomen as a movable tumor.

> Case in which a portion of liver was partly constricted off, and, remaining attached by a peduncle, gave rise to movable tumor. Removed with the gall-bladder; good recovery. Bastianelli (Il Policlinico, Apr., '95).

This deformity is met with usually in elderly females. There are usually no symptoms resulting from the deformity; yet in some there is said to be a constant sensation of pressure and weight in the hepatic region. In occasional cases, in consequence of venous stasis, there is a temporary swelling of the isolated portion and violent pain and signs of irritation of the peritoneum.

> Tight lacing has a decided effect on lessening the flow of bile. The free and unfettered action of the diaphragm is essential to normal biliary secretion and effects evacuation of the bile-ducts much in the same way as succussion of the liver which saddle exercise affords. W. G. Collins (Lancet, Mar. 17, '88).

2. **Tongue-like Lobes.** — These are probably of much more frequent occurrence, and therefore of much more importance, than the corset-liver. They are both of importance chiefly on account of the difficulties they present in diagnosis. Riedel met with twelve cases of tongue-like lobes in forty-two operations for gall-stones. I have met with nine in various conditions. In two the mass was thought to be a movable kidney, and in one, an infant with hæmorrhagic pancreatitis, it was thought that possibly the tongue-like lobe was an intussusception. They are met with at all ages, and are probably usually congenital rather than acquired from external pressure. The diagnosis of these malformations is usually easy if the abdominal wall is thin and lax, as the connection of the mass with the liver can be definitely traced; but if the abdominal wall is thick from the deposit of fat or its muscles tense it is often impossible to differentiate these from other masses met with in the abdomen. An effort should be made to outline the mass and trace its connection to the liver. This is often impossible, as the base may be deeply furrowed and a loop of intestine may occupy the groove.

Treatment for these abnormalities is rarely called for. When the mass is troublesome from its mobility, and is not retained by a suitable bandage, it may be removed. Such has been done successfully.

The chief interest in this subject is in connection with the diagnosis of abdominal tumors. Unless fully alive to the great variety, as to shape and position, in which these accessory lobes of the liver may present themselves, one will often be misled in the diagnosis of abdominal tumors. In not a few cases, even with the utmost care, a positive opinion as to the nature of these tumors cannot be given.

Riedel, who first drew attention to the importance of these abnormal lobes, believes them to be due usually to pressure on the liver, as in tight lacing, and to traction, by an enlarged gall-bladder. They are met with usually in women. In nine of his twelve cases the gall-bladder was attached to the lower part of the process.

So far as can be inferred from the nine cases which I have met, tight lacing has little to do with the production of the deformity, and the position of the gall-bladder at the lower part of the mass is an accident rather than a cause of its formation. In many, if not almost all, cases the formation of these lobes seems to be developmental, having nothing to do with either pressure or traction.

Displacements.

Displacements of the liver may be either congenital or acquired. As instances of the former are hernia of the liver through the diaphragm and through the anterior abdominal wall. Interesting examples are also afforded by transposition of viscera, the liver being found to the left and the spleen to the right. As a rule, the other organs, both of the thorax and abdomen, are also transposed, the cardiac impulse being in the fourth or fifth intercostal space to the right; but the liver and spleen may be the only organs abnormally placed.

Symptoms.—There may be none, the condition being discovered accidentally. On the other hand, they may be severe, consisting of pain, tension, and dragging sensation in the normal hepatic region. Jaundice, sometimes severe, has been present in a few cases, probably due to tension or kinking of the common bile-duct. Hypochondriasis is apt to develop. The diagnosis may be difficult. Other masses—as carcinoma of the omentum, tumors of the right kidney, etc.—have been supposed to be movable liver. Of the greatest diagnostic importance are the form of the tumor, its mobility, the possibility of reducing it to its normal position, the tympanitic note obtainable over the normal hepatic region before such reduction, and the dull note later.

Case in which diagnosis of tumor of large intestine, with atrophic cirrhosis, was made. Laparotomy showed liver entirely prolapsed and suspensory ligament entirely destroyed. Convex surface freshened and sutured in contact with parietal peritoneum. Two years and nine months later patient seen. Liver fixed to abdominal wall by extensive adhesions. Lanelongue and Faguet (La Sem. Méd., Aug. 7, '95).

Literature of '96-'97-'98.

Floating liver and distended gall-bladder mistaken for a floating kidney. W. W. Keen (Trans. Coll. of Phys., Third Series, xviii, p. 242, Jan.-Dec., '96).

Etiology. — Acquired displacements may be due to pressure upward by ascitic effusion, abdominal tumors, and flatulent distension, and downward by thoracic or subdiaphragmatic accumulations. These are, however, scarcely entitled to be included among liver-displacements. The movable or wandering liver is of more interst. The condition is not very rare.

Graham, in the Transactions of the Association of American Physicians, volume x, has tabulated sixty-six cases, all

of which have been reported during the last thirty years. It is found chiefly in females who have borne several children. The displacement is favored by a lax abdomen, tight lacing of the lower part of the chest, and sudden muscular strain. To render these causes effective it is probably necessary that the ligaments supporting the liver be abnormally long or weak: a condition that is doubtless congenital.

Treatment. — Treatment is not very satisfactory. A suitable bandage may relieve symptoms. The liver cannot be retained in the normal position by it, but further prolapse may be prevented and the liver so far supported as to relieve the pain and dragging. In a few cases the liver has been successfully sutured in position.

Case of painful movable tumor in the right iliac fossa which proved to be the displaced liver, adherent to the abdominal wall by a thickened portion of its capsule. The organ was pushed up as nearly as possible into its normal site, and fastened there by means of three catgut sutures passed through the thickened capsule and the deeper layers of the abdominal wall. Three months afterward the relief given was still complete. Richelot (L'Union Méd., Aug. 5, '93).

Literature of '96-'97-'98.

Case of fixation of movable liver. A Lagenbuch incision was made. The serous coat of the liver and corresponding surface on the parietes behind the costal cartilages were scratched with the knife so that adhesive exudation might be encouraged. Three No. 3 silks were passed to the depth of half an inch into the substance of the liver, and brought out between the cartilages of the false ribs; finally they were tied. Three more silks were employed to fix the liver to the upper part of the incision; they included peritoneum and muscle. A year and ten months later the patient was in good health. Blanc (Loire Méd., Dec. 15, '97).

Congestion of the Liver.

This pathological condition does not constitute a disease of itself, but is always associated with disease elsewhere, especially of the gastro-intestinal tract and the heart. The liver is particularly prone to disturbance of its circulation, because, in the first place, of its large blood-supply and, in the second place, on account of its relationship to the gastro-intestinal tract on the one side and to the heart on the other. As the bulk of its blood-supply is conveyed to it by the portal vein, it will share in all the congestive disturbances of the organs drained by the portal system. The increased *inflow* of blood resulting from these disturbances constitutes an active congestion of the liver. On the other side its proximity to the heart, and the absence of valvular structures between it and the heart render it very susceptible to any obstruction at the tricuspid orifice. Such conditions offer an impediment to the *outflow* of blood from the hepatic veins, and results in passive congestion of the liver.

Active Congestion.

Symptoms.—They are those of gastro-intestinal catarrh, such as headache, malaise, foul taste, coated tongue, constipation, etc. With these may be present a sense of discomfort, weight, or even pain in the region of the liver, which may also be tender on pressure. The liver may be felt below the costal margin. There may be slight jaundice; in the severe toxic cases the jaundice may be intense.

The urine is dark, of high specific gravity, somewhat scanty, and loaded with urates.

Diagnosis.—The diagnosis is based on the association of the symptoms of gastro-intestinal disturbance, with the en-

largement of the liver, with the discomfort in the hepatic region.

Literature of '96-'97-'98.

Case in which marked enlargement of the liver, associated with symptoms resembling those of typhoid fever, occurred in a young child. The enlargement began toward the close of the second week of fever, reached its maximum about the fourth week, and then slowly receded. It was associated with no tenderness, no ascites, no symptoms of jaundice. A. D. Blackader (Amer. Pediatric Society, May 26, '96).

Etiology. — There are two main groups of causes: (1) gastro-intestinal and (2) toxic. The most common of the first are catarrhal conditions of the stomach and intestines resulting from undue indulgence in food, and drink, especially if of a stimulating nature, as spices and alcohol. The habitual use of spirits to excess furnishes the most marked examples in these northern climates. Persons of sedentary habits are more liable to be affected, especially at middle age. Toxic causes occur in infectious diseases, especially in malaria, dysentery, typhoid fever, yellow fever, etc. Even these causes act chiefly through the gastro-intestinal tract. They are much more common in tropical climates.

Active congestion of the liver is also met with in suppressed menstruation and in diabetes mellitus. In both of these it has been attributed to vasomotor disturbance, but in diabetes the increased work thrown on the liver may be the chief cause.

Morbid Anatomy.—The liver is enlarged, dark in color and the vessels full of blood. The distension of the lobule with blood is not limited to the centre, but is general. There is often some fatty change in the liver-cells.

Treatment. — The indications are chiefly two: (1) to correct the habits that have mainly caused the condition and (2) to relieve the gastro-intestinal conditions and the hyperæmia of the liver. We aim at attaining both objects simultaneously. The diet should be of the blandest nature. In severe cases no food should be given until the bowels are acted on and the portal system depleted by a brisk laxative. Water should be taken freely on an empty stomach. The food should be regulated according to the needs of each case so as not to tax the digestive powers. Exercise should be free, but without undue fatigue.

Passive Congestion of the Liver.

Definition.—Passive congestion of the liver (nutmeg liver, cardiac liver, red or cyanotic atrophy of the liver), is a pathological condition caused by obstruction to the outflow of blood from the liver.

Symptoms.—The symptoms are chiefly those of the condition of the heart and lungs causing the hepatic congestion. There may be a sense of weight and fullness in the right hypochondrium, aggravated by external pressure, deep inspiration, and by lying on the left side.

Enlargement of the liver is one of the chief signs and is usually best demonstrated by palpation. When large, the liver can often be delimited by inspection. Percussion is usually unreliable on account of distension of the intestines.

Pulsation of the liver is often present in severe cases: it disappears when the induration develops and the heart becomes weak. I have seen it persist in cases of initial stenosis until within a few weeks of death.

Gastro-intestinal symptoms are always present. They result from the portal congestion induced by the hepatic obstruction. They consist in disturbed digestion, and, often, hæmorrhoids.

Ascites is frequent. In the early stage it occurs as a part of general dropsy. Later, when the liver becomes indurated it is increased by the portal obstruction. Jaundice is usually present, and is a definite symptom in the advanced cases. It is probably secondary to the gastro-duodenal catarrh. It is usually most marked in the cardiac cases, and, with the cyanosis existing in such cases, it causes a peculiar dusky-green tint, of the face especially.

Etiology.—The causes leading to this condition are such as lead to interference with the free flow of blood through the heart, and include, therefore, all changes in the heart and lungs which tend to render the right ventricle incompetent. Of the cardiac conditions the most common is mitral disease, especially stenosis; but all heart-lesions, whether of the valves or of the substance of the heart, tend to impede the venous flow by ultimately overtaxing the right heart. Such diseases of the lungs as emphysema, asthma, chronic bronchitis, etc., are also frequent causes of dilatation of the right heart, and thus lead to obstruction to the outflow from the liver.

Deformity of the spine, pleuritic effusion, aneurism, and intrathoracic tumors may obstruct the flow of blood through the heart and lungs or press upon the vena cava directly.

Occasionally a local lesion, as perihepatitis, may compress the hepatic veins themselves or the vena cava and obstruct the outflow from the liver.

Morbid Anatomy.—In the early stage there is great engorgement of the hepatic veins and their intralobular branches and capillaries. The liver may become much enlarged, its lower border extending in time to, or even below, the umbilicus. If the obstruction be removed before organic changes have occurred in the liver, the vessels rapidly empty themselves, and the liver returns to its normal size. Even after long-continued congestion the liver may be much smaller after death, unless escape of the blood from the hepatic veins is prevented by distension of the right ventricle.

Persistent hyperæmia leads in time to structural changes. As the intralobular veins are greatly dilated, the liver-cells around them atrophy from pressure, and blood-pigment is deposited. The centre of the lobule becomes dark, contrasting strongly with the periphery, which becomes yellowish, on account of fatty degeneration of its cells; hence the "nutmeg" appearance of the section.

In course of time atrophy of the liver-cells is succeeded by increase of connective tissue. Induration and shrinking result, and may lead to considerable reduction in the size of the liver.

Treatment.—The treatment is chiefly that of the condition of the heart or lungs that causes it, at the same time endeavoring to relieve portal congestion. The latter is usually effected by the action of cathartics. A more rapid effect may be obtained by local depletion with leeches, five or six being applied over the liver. Their application is usually attended by marked relief when there is pain and distress in this region.

Calomel, in repeated doses, is not only an active cathartic, but also an efficient diuretic in such cases. Digitalis may be combined with it to increase the power of the heart and secure greater diuretic effect. The condition of the heart requires the administration of heart-tonics, as digitalis, strychnine, etc. Vegetable cathartics — as podophyllin, colocynth, jalap, aloes, etc.—may be used, or salines, such as sulphate of soda, sulphate of

magnesia, or the natural purgative waters (such as Apenta or Hunyadi, Rubinat, Hawthorn, Friedrichshall), etc.

Perihepatitis.

This consists in an inflammation of the peritoneal capsule of the liver. Inflammation of the fibrous capsule apart from the peritoneal occurs only as secondary to interstitial hepatitis.

Inflammation of the peritoneal covering of the liver may occur either as a part of general peritonitis or as a local disease. It may be acute or chronic, the former being usually suppurative while the latter is always fibrinous or adhesive.

Acute Perihepatitis; Subphrenic Abscess; Pyopneumoperihepatitis.

Symptoms.—The development of the disease may be with striking symptoms suggestive of perforative peritonitis of the upper part of the abdomen, or it may be so insidious as not to attract attention until the abscess has attained a large size.

Pain in the right hypochondrium or epigastrium is the most prominent symptom. It is increased by pressure and movement: hence the respiration is shallow and costal. Fever, often ushered in by a chill, is present; it may be quite remittent. There may also be abdominal distension, vomiting, hiccough, slight jaundice, weak pulse, etc.

The physical signs presented will depend largely on the size of the abscess. In the beginning there may be a friction-rub. If the abscess is large there is presented great fullness in the right hypochondrium, with extension upward of hepatic dullness, even to the angle of the scapula, and of the edge of liver downward, it may be, to the umbilicus. The upper limit of dullness is convex toward the thorax, following the curve of the diaphragm. Over this area there is absence of all respiratory signs. The course of acute perihepatitis, in the absence of suppuration, may be rapid, recovery taking place in a few days; in suppurative cases it may be prolonged for months with all the symptoms of chronic suppuration, as irregular temperature, sweats, loss of flesh, etc. In many cases fistulous openings take place through the diaphragm, causing a localized empyema, which, in time, perforates the lung into a bronchus, with abundant purulent expectoration, or externally through an intercostal space. In others the abscess discharges into the stomach or intestine. The general course of subphrenic abscess resembles that of empyema or abscess of the liver. The result is usually fatal, unless efficient drainage be established. Of all the cases recorded only about twenty have recovered.

Diagnosis. — In subphrenic abscess the signs are so indefinite that a diagnosis is only exceptionally made. The abscess is usually mistaken for empyema. A history of disease of the stomach, duodenum, or gall-bladder would indicate a perihepatitis, as would also a history of abscess from appendicitis. The absence of a history of intrathoracic symptoms—such as cough, expectoration, etc.—renders pleuritic disease improbable.

The physical signs are those of massive enlargement of the liver; if the abscess-cavity contains air, the signs of movable dullness and tympany of pneumothorax are added. However, the bulging of the right side is greatest below the diaphragm rather than above. The diaphragm may be pressed upward to the third, or even the second rib, but, however high it is, its limits are well defined and above it the respiratory sounds are not obscured. The lower border of the liver may be greatly depressed. The

heart is not much displaced, as it is in pleural effusion.

On exploratory puncture, if the pus is reached, the spurting is most forcible on inspiration, owing to the descent of the diaphragm. This would practically be conclusive evidence of the seat of the abscess. The presence of bile-pigment in the pus would also indicate that the abscess is below the diaphragm.

Case of suppurative perihepatitis and abscess of the liver without any demonstrable connection between the two lesions. The pus of the peritoneal abscess was sterile, while from that of the liver proper pure cultures of the bacterium coli commune were obtained. Arnaud (Marseille-méd., Apr. 15, '93).

Etiology. — It occurs occasionally from a blow or direct injury. It is usually secondary to disease in some adjacent part or of the liver itself, such as perforating ulcer of the stomach or duodenum, perforation of the gall-bladder, perforation of the intestine or the appendix; abscess of, or in the region of, the kidney, spleen, or appendix; suppuration in the right pleura, the pyogenic organisms making their way through the diaphragm by the lymphatics; abscess of the liver, echinococcus cyst of the liver, suppurative cholangitis, etc.

Morbid Anatomy.—In the early stage the peritoneum of the liver and of the corresponding part of the diaphragm presents the signs of inflammation. The inflammation at the margins of the affected area being less severe, adhesion of the opposing surfaces takes place, while the exudate in the central part, being rich in leucocytes, liquefies, and an abscess results. The abscess may be small or so large as to contain a quart or more of pus. The pus may be creamy and odorless, but more often it is fœtid and contains necrotic tissue. It may be dark red from admixture of blood or green from bile. Occasionally air or gas is present, even when no communication with a bronchus or with the stomach or bowel can be found. These abscesses are found usually between the right lobe of the liver and the diaphragm, but may be over the left lobe.

Treatment.—In the early stages the aim of treatment should be to secure relief from pain and arrest of the inflammation. This is best effected by rest in bed, the application of five or six leeches over the seat of disease, and the hypodermic injection of morphine. Purging freely by salines may be of much benefit. Useful, but less effective, means than leeching are the local application of heat, poultices, sinapisms, or blisters. As soon as the formation of pus can be determined, free drainage should be resorted to. This may necessitate the resection of one or more ribs, but in any case the drainage should be as complete as possible.

Case of traumatic perihepatic abscess. Biological examination showed nothing present but the ordinary pathogenic microbes. Recovery after operation was very rapid. J. B. Gibbs (N. Y. Med. Jour., Dec. 21, '95).

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Case of subphrenic liver-abscess; transpleural drainage followed by pyæmia, and finally recovery. Gerster (Annals of Surg., May, '98).

Chronic Perihepatitis.

This condition may be local or general. Local perihepatitis is always secondary. It is seen, for example, around the gall-bladder in some cases of gall-stones; over a tumor in the liver; at the point of adhesion to the liver of an ulcerated stomach or intestine; as the result of a local tuberculous or carcinomatous deposit; and in many cases of venous obstruction

whether from cardiac or pulmonary disease. It may result also from pressure, as in the furrows produced by tight lacing or constriction of the liver from any cause.

General perihepatitis is a very different condition. Our knowledge of it is derived chiefly from the records of Guy's Hospital. In "Allbutt's System of Medicine," volume iv, Dr. W. Hale White gives a valuable account of the condition based on these records. In it "the whole capsule becomes thick, opaque, and white . . . easily peels off the subjacent liver, the surface of which is smooth; and for some unexplained reason it is quite common to find the inferior edge folded up on to the anterior surface of the liver." This thickened capsule is often pitted deeply. The liver is usually slightly atrophied, but otherwise little altered. The thickened capsule does not seem to cause pressure upon the vessels at the transverse fissure. The capsule of the spleen and the general peritoneum is usually also thickened. The omentum may be thickened and contracted, forming a tumor across the abdomen.

Of the 22 cases analyzed by White in 19 there was chronic granular kidney, and he thinks the chronic peritonitis and general perihepatitis should be regarded as a sequel to the renal disease. Ascites, resulting probably from the chronic peritonitis, is nearly always abundant and requires repeated tapping. These cases are doubtless frequently looked upon as cirrhosis of the liver. Further study of the condition is much needed.

Acute Yellow Atrophy of the Liver (Malignant Jaundice).

Definition.—A grave form of jaundice characterized by extensive destruction of the liver-cells, with atrophy of the liver and clinically by grave constitutional disturbance in which the cerebral symptoms are especially prominent.

Symptoms.—In the prodromal period there is no time to distinguish it from ordinary jaundice. The same symptoms usher in loss of appetite, malaise, nausea, and vomiting, jaundice following in a day or two. It differs from ordinary jaundice in the occurrence of some rise of temperature.

> Grave infectious icterus, although usually attended by hyperpyrexia, may present a subnormal temperature. The disease is due to bacillus coli communis. Hanot (Le Bull. Méd., Apr., '93).

This stage may last from a few days to two or three weeks. The bowels are constipated and fæces pale; the urine contains bile-pigment. There may be pain in the hepatic region.

Suddenly a marked change occurs, characterized by severe headache, repeated vomiting, delirium, and restlessness. The vomited matters are at first bile-stained and later contain blood more or less altered, and the stools may also contain blood, making them dark and offensive. At the same time the jaundice deepens and becomes of a greenish hue. The temperature falls to normal, or usually below it; the pulse rises to 120 or more and becomes weak. Stupor sets in and deepens into coma. There may be convulsions. In women menorrhagia may occur and, if pregnant, abortion or premature delivery take place.

Literature of '96-'97-'98.

> Case of acute yellow atrophy in a woman who had passed through five normal labors and presented a high degree of jaundice during her sixth pregnancy. The liver-dullness extended over an area only two or three fingers' breadths in extent and the urine was covered with bile, but otherwise there was no abnormal signs or symptoms. The patient sank into a state of stupor, gave birth to a macerated fœtus, and died two days

later. H. Thompson (Centralb. f. Gynäk., Nov. 12, '98).

The urine becomes deeply bile-stained and often contains tube-casts. It becomes lessened and may be suppressed. There is great diminution, or even absence, of urea, and its place usually is taken by abnormal constituents, especially by tyrosin and leucin.

Literature of '96-'97-'98.

A case of acute yellow atrophy following syphilitic infection. For the last fourteen days of life daily examinations were made of the urine to determine the amount of urea, ammonium, the alloxin bodies, and the uric acid excreted. The total quantity of nitrogen remained almost constant. The urea was perfectly normal in amount until the last two days, when, during the existence of severe coma, there was a moderate reduction. The ammonium was slightly increased, but hardly enough to be supposed to be the result of insufficiency of the hepatic cells and consequent imperfect formation of the urea. Richter (Berl. klin. Woch., No. 21, '96).

The most characteristic physical sign in this stage is the rapid diminution, it may be disappearance, of the area of hepatic dullness; so that the hepatic area may become tympanitic. It is also frequently tender to pressure, even in the comatose state.

The stage lasts only two or three days and nearly always terminates fatally.

Diagnosis.—It is not possible to distinguish acute yellow atrophy before the development of the grave symptoms. Then the symptom group is characteristic: intense jaundice; severe, persistent vomiting, rapid disappearance of hepatic dullness; delirium, passing rapidly into coma; leucin and tyrosin crystals in the urine.

Hypertrophic cirrhosis sometimes presents similar symptoms, but the long duration and the large liver serve to exclude this affection. In this the symptoms of icterus gravis may develop and the case present all the features of acute yellow atrophy.

Phosphorus poisoning closely resembles acute yellow atrophy, but the liver does not diminish so rapidly, if at all, the nervous symptoms are not so grave, leucin and tyrosin do not usually appear in the urine in phosphorus poisoning, and the gastric symptoms are usually more severe.

Etiology.—This disease is rare. Until 1894 Hunter found but 250 cases recorded, and since then (1895 to 1898, inclusive) I have found the reports of 29 cases. A few observers have, however, seen several cases within a few months, indicating an endemic agent, while others with large experience have not met a case. I met with one in 1890 in the Toronto General Hospital.

No age is exempt, from the infant of a few days to the octogenarian. It is most common between the ages of 20 and 30 years.

It is more common in females than males, especially between the ages of 20 and 40; that is, during the childbearing period. Pregnancy has a most important bearing on the causation, nearly half the cases met with in women occurring during pregnancy, especially the latter part of it. This is probably explained by the fact that some degeneration of the cells of the liver and kidney is a common condition in pregnancy. Fear and mental emotion have apparently been the cause in a few cases.

Case of acute yellow atrophy in which the onset of the symptoms dated from a visit of the patient to the scene of a railroad accident. Psychic trauma had much to do with the development of the disease. Stress laid upon the occurrence of ascites as a complication of acute yellow

atrophy. Burckhardt (Corres.-blatt f. Schweizer Aerzte, Aug. 14, '91).

Alcoholic excess has preceded the disease in several cases. The disease may be the result of various infections, such as typhoid, diphtheria, and septicæmia. The resemblances of the symptoms to those of phosphorus poisoning are undoubted, but there are essential differences in the resulting morbid changes that render it clear that the two conditions are not identical. In view of the variety of conditions under which the disease occurs, it is highly probable that it is due to various forms of infection.

Morbid Anatomy.—The liver is greatly reduced in size; it may be less than half its normal weight. It is thin, flabby, and wrinkled in appearance.

On section it is tough rather than firm. The cut surface varies in color from a yellowish to a reddish brown and is often mottled irregularly. The lobules are small and indistinct; in the parts most advanced in degeneration they cannot be distinguished.

On microscopical examination the liver-cells are found greatly degenerated, containing swelled, indistinct nuclei and fat-granules. In many parts they have been entirely replaced by fat-granules and *débris* held together by the liver-stroma.

Essential anatomical changes in yellow atrophy: a fatty degeneration and necrosis of liver-cells, produced by several different infections, of which syphilis may be one. E. Meder (Beiträge zur path. Anat., etc., B. 16, p. 143, '95); Marchand (Beiträge zur path. Anat., etc., B. 16, p. 206, '95); Huber (La Presse Méd., June 19, '95).

Literature of '96-'97-'98.

Case of acute yellow atrophy of the liver in a boy of 4 years. At the autopsy there was cheesy degeneration of the lymph-glands at the root of the lung; enlarged spleen, and a small, firm, tough liver, filled with yellow areas and some small red points. Microscopically the cells showed indefinite contours, poorly-staining nuclei, and fatty degeneration. The central veins were greatly dilated and surrounded by a round-celled infiltration. Friederich Lanz (Wien. klin. Woch., July 23, '97).

In less degenerated parts the periphery of the lobules is most affected where the cells are disintegrated and the biliary canaliculi distended with desquamated epithelium and granular masses of bile-pigment, constituting a complete obstruction to the flow of bile. In these parts active cell-division may be found, as if an effort were being made to regenerate the hepatic parenchyma. It is possibly due to this activity that recovery takes place in rare cases.

In acute yellow atrophy, the poison, whatever its nature may be, may affect the liver very unequally and in different degree. Thus, in the same liver there may be found areas in which the liver-cells have still their nuclei well preserved, others in which the cells are entirely necrosed, and others again in which the liver-cells have disappeared; in the last, if there has been sufficient time, proliferative changes are well marked. It is also quite possible that in certain cases the poison may act only locally, and that recovery may take place. Stroebe (Ziegler's Beiträge, vol. xvii, p. 206).

The larger bile-ducts are usually free from bile, containing mucus only; the gall-bladder often contains a little bile.

Micro-organisms of various kinds have been found in some cases, but not with such constancy as to indicate that they take any active part in the causation of the disease.

These briefly were the conditions found by Prof. A. B. Macallum in a case of mine in 1890, and from them he concluded that the disease is caused by a toxic agent carried to the liver by

the portal vein and, therefore, originating in the intestine (Brit. Med. Jour., volume i, '94).

There is general bile-staining of other organs and tissues. Numerous hæmorrhages are found in various situations. The heart, voluntary muscles, and renal epithelium usually show fatty degeneration. The spleen is large and there may be considerable effusion into the pleural and pericardial cavities. There are evidences of catarrh in the digestive tract.

Case of acute yellow atrophy complicated with multiple cerebral hæmorrhages. Lafitte (Bull. de la Soc. Anat., No. 16. '91).

Literature of '96-'97-'98.

In acute yellow atrophy the cord may show changes which seem to be, like atrophy of the liver, the result of the severe general intoxication. Goldscheider and Moxter (Fortschritte der Med., No. 14, '97).

Prognosis.—The disease is so fatal that recovery almost implies a mistake in diagnosis.

The statistics of the Havana Civil Hospital show that acute yellow atrophy is by no means necessarily fatal, as there have been 11 recoveries, besides 1 which was returned as improved. Martinez (Rev. de las Ciencias Med., p. 100, '89).

Case of favorable termination of acute yellow atrophy, it being the sixteenth on record. The patient was nourished for a month by rectal injection of peptone, eggs, and milk. Weising (Schmidt's Jahrbucher, Aug. 15, '92).

Treatment.—This is purely symptomatic. There are no remedies known to have any influence on the disease.

Treatment is never very effectual in acute yellow atrophy, but the main indications are to be met at first by cathartics and later by tonics. Martinez (Rev. de las Ciencias Med., p. 100, '89).

Abscess of the Liver.

Symptoms.—The outset of the disease is always insidious and the course may be latent throughout, an unsuspected abscess being found at the autopsy. When not latent, the cardinal symptoms are: fever, with free perspiration, pain, enlargement of the liver, and signs of septic infection. There is loss of appetite, more or less rapid emaciation and increasing weakness and anæmia. There is a sense of weight and distress in the epigastric and right hypochondriac regions, with sometimes hiccough, nausea, and even vomiting. An icteroid hue develops, rarely, marked jaundice. The temperature is elevated from the first and is of a septic character. It is irregular, being normal at times, then rising to 103 or more, with a more or less marked chill, to defervesce again with profuse sweating. These variations may be so regular as to clearly simulate malarial fever, but the variations lose their regularity in a few days. In other cases typhoid fever is simulated. With the evacuation of the pus, the temperature may fall to normal and remain so; much will depend on the thickness of the abscess-wall and whether other foci of suppuration co-exist. The pulse-rate varies in general with the temperature, but toward the end of life it becomes greatly accelerated and feeble.

Pain is variable, and probably is not present until the abscess approaches the surface of the liver. It is usually referred to the scapular region, but may be felt in the region of the liver. The patient usually finds lying on the back or right side most comfortable; on the left side the liver drags on its ligaments and any inflammatory adhesions that may be formed and causes discomfort. Pressure at the costal margin, especially in the nipple-line, is usually painful.

Enlargement of the liver is most

marked in the right lobe, and may be more apparent in the erect posture. In multiple abscesses and pylephlebitis the enlargement is general and rarely great. In tropical abscess when situated, as it usually is, in the dome of the liver, the enlargement is chiefly upward, contrasting with the downward enlargement usual in new growths of the liver. The area of thoracic dullness may be sharply convex upward and rise to the fifth rib in the midaxillary line and posteriorly to the angle of the scapula. It has been reported to even reach the second rib in front and the spine of the scapula behind. In these cases of extremely large abscess the right side is bulged and the lower margin of the liver depressed, it may be, to the iliac crest; over the liver there is tenderness and often crepitus to palpation; and occasionally fluctuation may be elicited.

No local pain in hepatic abscess, except in rare instances. Tschernow (Wratsch, Nos. 35, 39, '94).

Two cases of abscess of the liver in army-officers, aged 28 and 27 years, respectively. In each case dysentery had preceded the hepatic abscess, and the pus had made its exit through the bronchial tubes. The symptoms were extreme emaciation and anæmia, a constant cough with very free expectoration of pus, fever varying from 102° to 103.5° F., a good appetite, and no diarrhœa. Both made good recoveries. Ferron (Jour. de Méd. de Bordeaux, Apr. 23, '93).

Literature of '96-'97-'98.

The absence of rigors is more often a feature of chronic abscess than of acute. Dreschfeld (Med. Chronicle, June 1, '97).

Tropical abscess of the liver may run its entire course without giving any subjective symptoms that would attract the physician's attention to the liver.

Absorption-icterus is rare in tropical abscess. In the cases of abscess of portal origin icterus is relatively more frequent. The involvement of the peritoneal covering of the liver causes severe pain on respiration.

Involvement of the phrenic nerve and the diaphragm is responsible for some of the most constant manifestations of hepatic abscess of amœbic origin. Pain may be referred to the shoulder-joint; scapular, clavicular, or deltoid region; or to the side of the neck, or may even extend down the inner aspect of the arm and forearm.

The pain may be sharp, lancinating, or dull, or simply a sense of tension or fullness in this region.

Tussis hepatica is due to phrenic irritation: it may occur with abscess or gallstones. Hiccough is produced through the agency of the phrenic nerve. The patient may suffer with dyspnœa. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Sept., '97).

Owing to the frequent situation of the abscess in the dome of the liver, implication of the lung is more frequent in the tropical, or amœbic, cases than in the septic ones occurring in our northern climates. The pulmonary symptoms often occur early and become so pronounced as to obscure the hepatic symptoms. They usually consist of stitch-like pain and signs of exudation into the pleura in the right axillary region, dyspnœa, and lacking cough with little expectoration. Later, when the abscess discharges into the bronchi, severe paroxysmal cough develops, with abundant expectoration, often greatly increased on lying down. The sputum consists of a "dirty-red or brownish puriform matter. There is no matter like it expectorated in any disease of the lung itself, and I believe that its appearance is pathognomonic of abscess of the liver, or, at least, of abscess perforating the lung" (Budd).

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Case of abscess of the liver discharging through the lung. After several unsuccessful attempts, the abscess was discovered and drained. C. A. Morton (Lancet, Aug. 8, '96).

Liver-abscesses may communicate with various organs and cavities. The most common secondary invasion is undoubtedly through the diaphragm into either the right pleural sac or directly into the lower lobe of the right lung. Thierfelder collected 170 cases of liver-abscess, of which 76 opened into the lung and bronchi, 23 into the abdominal cavity, 32 into the intestine, and 13 into the stomach. Aghetti collected 131 cases, of which 38 broke into the lung. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Aug., '97).

Two cases of amœbic abscess of the liver reported, together with the only one that could be found in the literature in which secondary perforation of the inferior vena cava resulted. Flexner (Amer. Jour. Med. Sci., May, '97).

A slight degree of jaundice is not rare; it may vary with the variations of temperature. Exceptionally more marked and prolonged jaundice is caused by pressure of the abscess on the common bile-duct. Ascites may result in a similar manner from pressure on the portal vein.

Diagnosis.—As the suppurative process in the liver may be latent, it is often impossible to make a diagnosis of hepatic abscess, especially in the early stage.

The occurrence of pain in the right hypochondrium or in the scapular region, some enlargement and tenderness of the liver, and irregular fever, usually with chills more or less marked, in a case with a history of ulcerative processes anywhere in the digestive tract affords fairly certain ground for a diagnosis.

Attention called to the perihepatic friction in suppurating hepatitis as a diagnostic sign that may be perceived both by ear and hand, and precedes by several days œdema of the parts. It is also evidence that the liver is fixed to the abdominal walls by adhesive peritonitis. Bertrand (La Sem. Méd., Mar. 9, '90).

Diagnosis of suppurative hepatitis based upon localization of the pain, with irradiation to the shoulder, the nature of the temperature-curve, and the exclusion of pleurisy. Barthélemy and Bernardy (Archives de Méd. et de Pharm. Milit., Apr., '90).

The apparent enlargement of the liver, in a case in which abscess or cancer had been suspected, was apparent only, and was the result of a localized peritonitis, which had pushed the liver down. The organ was held down by fibrous bands, the result of organized lymph. Pepper (Univ. Med. Mag., Aug., '91).

If discharge takes place through the lung the character of the pus may be sufficient to establish the diagnosis; especially if amœba be found in it, otherwise abscess of the lung or empyema will have to be excluded.

Case in which the diagnosis rested upon the presence of amœba coli in the sputum. Symptoms were constipation; pain in side; cough, with blood-stained sputum; stools containing mucus and blood; no chills, but fever at times and sweats. Later, sputum resembled anchovy-sauce; actively-moving amœbæ were found in it; liver enlarged behind; dullness at base of right lung and feeble breathing, which at angle of scapula was tubular, with large râles. Had amœbæ not been found, the case would have been regarded as one of pleurisy. Simon (Johns Hopkins Hosp. Bull., Nov., '90).

Case of multiple liver-abscess, secondary to pelvic peritonitis, following salpingitis. Patient was supposed to be suffering from phthisis. There were no definite symptoms calling attention to the liver or pelvic viscera. De Silva (Ceylon Med. Jour., July, '90).

Case in which the diagnosis of empyema was made, because exploratory puncture and the physical signs pointed to this condition. At the autopsy absolutely nothing was found in the pleural cavities except a very slight pleuritis on the right side. In the posterior and upper part of the right lobe of the liver, however, was a very large abscess-cavity, which communicated with the operation-wound. The diaphragm was intact. J. M. Byron (Med. Rec., Aug. 4, '94).

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Of diseases in the liver-region abscesses of the base of the right lung are not uncommon and present many features of similarity. In both there is increased area of dullness, pain is similar in character and location, cough is a feature of each, and the constitutional symptoms are more or less parallel. The history leading up to the illness is quite dissimilar in most instances. Pulmonary abscess is constantly preceded by pneumonia; hepatic abscess by dysentery, suppurative processes within the bounds of the portal system, or suppurative cholangitis. The sputum from a ruptured abscess of the lung is of purulent nature, stained with blood, while that from abscess of the liver is often of reddish-brown color, like anchovy-sauce.

The pulsating pleurisy, encysted empyema, and subphrenic abscess are also affections extremely difficult and often impossible of differential diagnosis. In pyothorax dyspnœa is ordinarily more pronounced, and there may be a slight resonant space between the pleural pus-collection and the liver.

In suppurative appendicitis, the previous history, the presence of the tumor, the location of the pain, the resistance of the abdominal muscles, together with the absence of functional disturbances of the liver, generally suffice to clear away all doubt.

In paranephric or perinephric abscess of the right kidney it is well to remember that this is frequently the result of disease of the kidney, or by extension of inflammation from neighboring parts, that its origin is never spontaneous, that it occurs twice as often in adult males as in females. Pain and swelling in the lumbar region are the localizing symptoms. John G. Cecil (Amer. Pract. and News, Apr. 17, '97).

Perforation externally may render diagnosis easy. If the abscess is in the liver the needle inserted into it will move with the respiratory movements of the liver unless adhesions be so firm that the liver is quite fixed. Empyema of the gall-bladder would, of course, move with the liver, as might also an abscess adherent to the under surface of the liver.

Attacks of gall-stone colic with marked intermittent fever often closely simulate hepatic abscess. In the gall-stone cases the attacks of fever are paroxysmal, with severe pain, and sweating. The attacks may recur with great regularity. In the intervals between the attacks there is complete apyrexia, and the general nutrition is well maintained. Such a history may be continued for years.

Case in which abscess gave passage to thirty gall-stones. Covert (Chicago Med. Times, Aug., '95).

As abscess of the liver is a secondary affection, the previous history is important. The primary disease may be dysentery, ulcer of the stomach, hæmorrhoids, rectal ulcers, appendicitis, etc.

Case of hepatic abscess at first diagnosed as tertian ague, and always relieved while under quinine, but always recurring. Later, the correct diagnosis was made and operation performed. J. J. Bland (New Orleans Med. and Surg. Jour., Aug., '90).

Fatal case of hepatic abscess, in which during life a diagnosis of cancer had been made. Bezançon (Bull. de la Soc. Anat., Jan., '94).

Case of hepatic abscess simulating ulcer of the stomach. Texier (Le Bull. Méd., June 2, '95).

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Certain cases of enteric fever present a clinical picture resembling liver-abscess. The type and course of typhoid, when unmodified by antipyretics, in comparison with the more erratic chill, fever, and sweat of hepatic abscess is sufficient, together with the other usual manifestations of typhoid, to make the distinction clear.

Cancer of the liver differs from an abscess by its dissimilar history, by the hard nodular masses, and by absence of fluctuations. Further, the marked fever

and other constitutional symptoms are not like what occurs in hepatic cancer. In cancers the superficial veins are enlarged and œdema of lower extremities common. From a suppurating hydatid cyst of the liver an abscess can scarcely be diagnosticated. John G. Cecil (Amer. Pract. and News, Apr. 17, '97).

The most common error is to regard the hectic of liver-abscess as attributable to malaria. If carefully considered there are several circumstances which should obviate this error:—

1. No uncomplicated ague resists quinine in full doses.

2. In malaria, if the liver be enlarged, the spleen is still more so; the reverse is the case in liver-abscess.

3. The plasmodium cannot be found in the blood in non-malarial hepatitis.

4. In liver-abscess the fever is almost invariably an evening one; in malaria it most frequently comes on earlier in the day.

5. Quotidian periodicity, contrary to what is the case with tertian or quartan periodicity, is by no means pathognomonic of nor peculiar to malaria.

6. The almost invariable history of antecedent dysentery or, at least, of intestinal disorder in liver-abscess. Ed. E. Field (Ga. Jour. Med. and Surg., Dec., '98).

The existence of leucocytosis may prove of importance as indicative of suppuration. The diagnosis may sometimes be established by aspiration: an operation that may be resorted to without any great degree of danger. Of course, failure to find pus does not negate the existence of abscess, as the needle may not reach it or the contents may be too thick to enter the needle. The patient should be anæsthetized, as many punctures may be required. The needle should be inserted in the lowest interspace in the anterior axillary line, in the seventh interspace in the midaxillary line, or in the centre of the dull area behind. The needle should be used only to determine the necessity for drainage.

Etiology.—Abscess of the liver results occasionally from traumatism, as from a blow or a punctured wound.

Abscess of the liver is very rare in children. From study of 37 cases the average of occurrence was found to be a little less than nine years. The youngest was an infant of one year; the oldest fifteen years old. Injury was the assigned cause in 9 cases. The next most frequently assigned case is round worms, which have migrated from the intestine into the bile-ducts and there set up an inflammation. In the remaining cases the abscess was secondary to a pylephlebitis in 4 cases, to an umbilical phlebitis in 1, to pyæmia in 2, to dysentery in 3, to pelvic peritonitis, perityphlitis, malarial fever, and tuberculosis of the lungs in 1 each. R. M. Slaughter (Virginia Med. Monthly, Oct., '95).

Apart from traumatism, the two chief avenues by which bacteria gain access to the liver and excite suppuration are the portal vein and the bile-ducts. Of these, the portal vein is the chief one, as it may convey germs from any part of the digestive tract: hence the frequency with which abscess of the liver follows ulcerating lesions of the intestines, as dysentery, appendicitis, hæmorrhoids, and other rectal diseases.

Abscess of the liver is a micro-organismal disease, the principal factor being a streptococcus. Dysentery is a disease of the same character, produced by a streptococcus. The point of entrance of micro-organisms found in the liver is chiefly the intestinal tract, whence they pass to the liver either with the portal blood or the general circulation. Zancarol (Revue de Chir., Aug. 10, '93).

At autopsy of case of hepatic abscess several calculi were found, the largest of which had become impacted in the ductus choledochus, and by pressure on the portal vein had led to the formation of a thrombus. This had later broken down and become the source of multiple abscesses. Geigel (Zeit. f. klin. Med., B. 16, H. 3, 4, '89).

Formation of gall-stones regarded as

most frequent cause of liver-abscess in Germany. W. Korte (Deut. med.-Zeit., July 28, '92).

Case of abscess due to duodenal ulceration caused by extensive burns, pus containing ordinary micrococci. Hehir (Indian Med. Record. June 16, '95).

Abscess in which pus showed tubercle bacilli. Churton (Lancet, Mar. 9, '95).

A case of abscess of the liver following typhoid fever in which the pus of the abscess contained the bacillus of typhoid. Abscesses of the liver following this disease divided into those due to metastasis, those due to typhoid ulceration of the biliary passages, and those due to typhoid pylephlebitis. Lannois (Rev. de Méd., Nov., '95).

Emboli from these sources may excite suppurative pylephlebitis, from which abscesses may result by extension into the liver-substance.

A case of abscess of the liver due to pylephlebitis following typhoid fever. Schultz found no instances among 3686 patients with 362 fatal cases; Romberg saw 1 among 677 cases, with 88 deaths; Dopfer saw 10 in 927 autopsies. There was no cause for metastatic abscess nor any typhoid ulceration of the biliary passages or gall-bladder. The abscess was due to ascending thrombosis beginning in the intestines, and the bacillus of Eberth was found in the abscess. Lannois (Rev. de Méd., Nov., '95).

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A case of abscess of the liver which developed a few months after perityphlitis. Fränkel's diplococci were found in the pus. Hermes (Deut. Zeit. f. Chir., No. 6, '96).

Infective processes in the umbilical cord in infants may extend along the vein to the liver and produce one or more abscesses. In a similar manner they may result from abscess of the spleen.

In general pyæmia abscess of the liver is rare, as the germs have to pass through the lungs to reach the liver. Suppurative wounds of the head are, however, followed by hepatic abscess with comparative frequency. It may possibly happen in these cases that the infectious agent reaches the hepatic veins by "retrogressive embolism" from the vena cava.

Next to the portal vein, the most common avenue of invasion of the liver by pyogenic organisms is the bile-duct. The germs originate in the intestine, and the inflammation resulting from their presence in the duct is probably always preceded by injury, usually from pressure of a gall-stone, more rarely from the irritation of a parasite.

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Abscess of the liver caused by a pin. Both the head and the stem of the pin were incased in calcareous matter, so that it measured nearly three millimetres in diameter. Alexander Lambert (N. Y. Med. Jour., Feb. 5, '98).

In tropical climates there is close association between abscess of the liver and dysentery: an association apparently explained by the discovery of the presence in both of the amœba coli. But the amœba is not found in all cases of hepatic abscess in hot climates, and probably other organisms are the active agents in the production of many cases.

Attempt made to explain the connection between dysentery and hepatic abscess. In the intestinal ulcers of over 500 cases of dysenteric origin amœbæ (proteus vulgaris) were discovered, while they could not be found in abscesses due to other causes. Sharp distinction to be drawn between dysenteric and idiopathic tropical abscesses which are due to pyogenic micro-organisms coming probably from the gastro-intestinal tract. Kartulis (Virchow's Archiv, Oct., '89).

In a tropical hepatic abscess not dependent upon dysentery, pure cultures of staphylococcus pyogenes aureus found. Amœbæ were not present. Macfadyen (Brit. Med. Jour., July 15, '93).

Several cases of multiple abscess of the liver reported. In the pus of one, the

staphylococcus pyogenes albus; in another, the staphylococcus pyogenes aureus and a streptococcus; in a third, a staphylococcus and the bacterium coli commune were found. Clark (Practitioner, Oct., '93).

Bacteriological examination of the pus of an abscess of the liver following dysentery revealed many micro-organisms, as the staphylococcus pyogenes, the bacillus of Eberth, and a microbe not yet determined. The pus of these abscesses is not sterile, or such a sterility is only apparent. Nertrand (Le Bull. Méd., Apr. 18, '94).

Sterile pus is found mostly in old abscesses, while the acute ones contain micro-organisms; therefore, hepatic abscesses are of microbic origin, but the microbes die rapidly in their pus. Laveran (Le Bull. Méd., Dec. 6, '93).

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A case of dysentery followed by abscess of the liver in which the amœba coli was found in the abscess-cavities, though none was discovered in the intestines post-mortem. Manner (Wien. klin. Woch., Feb. 20, '96).

The statistics collected by Councilman and Lafleur show that in India in 1429 autopsies on persons dying of dysentery, liver-abscess occurred in 306. In Algiers, of 1001 autopsies on dysenteric cases, 180 had liver-abscess. According to Kartulis, of 500 cases of dysentery, from 50 to 60 per cent. had liver-abscess. Of 40 American cases personally collected, 18 had liver-abscess. Liver-abscess may occur in the acute form of dysentery, but it is more common in the chronic variety. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Aug., '97).

Bacteria are not uncommonly associated with amœbæ in the liver-abscesses and lung-abscesses, as well as in the intestinal lesions.

While careful search practically always demonstrates the presence of amœbæ in the secondary liver, lung, and pleural abscesses occurring during the course of or following amœbic dysentery, very little is known of the etiology of the so-called "idiopathic" abscesses of the liver.

It is not impossible that least some cases of the idiopathic liver-abscesses are caused by amœbæ that have penetrated to the submucosa of the intestine possibly through small breaks in the mucous membrane or even through the unbroken mucous membrane, causing only slight local lesions, and, getting into the lumen of small veins, may reach the liver. Another possibility is the presence of one or more small amœbic ulcers in the rectum, colon, or cæcum, or even the small intestine or the stomach, which are too small and insignificant to cause diarrhœa or other symptoms. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Sept., '97).

There is a special form of dysentery in which amœbæ are constantly present and also in the pus of certain tropical abscesses of liver the same bodies are found. Amœbæ coli have been found in the stools of patients who were not at the time suffering from dysentery. This fact may account for some cases of hepatic abscess in which there is no trace of a dysenteric connection. C. W. Windsor (Lancet, Dec. 11, '97).

Hepatic abscess may originate in patients who many years previously have suffered from dysentery. Josserand (Jour. de Méd., July 25, '98).

Case of hepatic abscess without history or symptoms of dysentery; yet the amœba coli was found in abundance in the pus which escaped after incision. G. R. Turner (Lancet, Feb. 15, '98).

Morbid Anatomy.—In septic cases the abscesses are usually multiple and irregularly distributed throughout both lobes. Traumatism may give rise to a solitary abscess, and such may also result from a single embolus. The liver is usually uniformly enlarged. Its surface may present no abnormal appearance. In many cases, however, there are yellowish points showing beneath the capsule. On section isolated pockets of pus are found varying in size from a small point up to three or four cubic millimetres or more in diameter, the larger ones being probably formed by the coalescence of two or

more smaller abscesses. Many are dendritic in form, and on examination are found to communicate with the portal vein, being doubtless formed by suppuration of its branches. The walls of the abscesses are shreddy, especially in the larger ones, and the cavity may be divided by many trabeculæ. The contents vary according to the age of the abscess and the nature of the infective agent: they may be thick and viscid; or fœtid, bile-stained, and containing masses of necrotic tissue; or the pus may be thick and laudable. All the branches of the portal vein in the liver may be involved, but sometimes thrombi circumscribe the infection and preserve sections of the liver from invasion. The suppurative process may extend backward even into the gastric and mesenteric veins.

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The small abscesses may be microscopical in size. Their contents consist of firmly granular material, with here and there cellular and nuclear fragments, and in some there is fibrin. Few, if any, leucocytes are seen, but red corpuscles may be numerous. Amœbæ are always numerous in the smaller abscesses, being more numerous about the periphery, extending in places into the liver-tissue, but not usually beyond the area of tissue-necrosis. A few may be found in the capillaries. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Aug., '97).

If infection has taken place through the bile-ducts, obstruction by gall-stones usually exists and the gall-bladder and the bile-ducts generally may be dilated and full of pus, often bile-stained.

Very large abscesses may result from suppuration around echinococcic cysts; their nature is indicated by the presence of portions of the cysts.

Tropical Abscess. — There may be one or more; in the latter case there is usually one larger and evidently much older than the others. They may vary in size from a few millimetres in diameter up to an orange or even to a child's head. The larger abscesses usually occupy the right lobe, being situated, as a rule, at the under surface above the hepatic flexure of the colon or in the dome of the liver (Lafleur). In Waring's statistics of three hundred cases, in 62 per cent. there was only a single abscess. The small multiple abscesses are usually superficial. In the smaller abscesses, being more recent, the walls are shreddy and not sharply defined from the contiguous inflamed liver-substance. Their contents vary from a yellowish gray to a reddish-brown (due to the presence of blood), and often contain shreds of necrotic liver-tissue. In old abscesses the walls are firm, thick, and fibrous. The contents of all the abscesses are chiefly remarkable in the small number of leucocytes that are present.

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When the abscess is single it is far more frequently found in the right lobe and nearer to the upper surface. Waring found that out of 288 cases of tropical abscess 177 were single. The pus from a true tropical abscess shows a complete absence of pyogenic organisms. Osler expresses the opinion that the pus of tropical abscess is quite free from pyogenic bacteria. Macfadyen holds that in tropical abscesses pyogenic organisms are constantly met with, staphylococcus pyogenes aureus being the commonest, while the staphylococcus albus and streptococcus pyogenes are often found. C. W. Windsor (Lancet, Dec. 4, '97).

Case of tropical abscess of the liver containing the amœba coli, in which the discharge from the abscess was examined from day to day. On the sixth day after the operation it was found that the leucocytes had very greatly increased, that the amœbæ were rapidly disappearing, and that, while bacteria had previ-

ously been absent, there had now appeared Fränkel's pneumococci, streptococci, and the colon bacillus. Peyrot and Roger (Rev. de Chir., Feb., '97).

When the abscess reaches the surface it may rupture and pus escape into the peritoneal cavity, or, adhesions having previously formed, the pus may penetrate in any direction. It may discharge into the stomach, the intestine, the pelvis of the right kidney, or through the diaphragm into the pleural or pericardial sac. Adhesion of the lung to the diaphragm usually precedes its advent in this direction, and then the lung is invaded, an abscess forming and discharging into the bronchi. It may also perforate the thoracic wall and appear beneath the skin.

Prognosis. — Suppurative hepatitis is a grave disease, the mortality being over 50 per cent. In rare cases of single small abscesses and of mild cases of pylephlebitis recovery possibly takes place by absorption or inspissation and calcification of the pus. There is, however, room for doubt as to the diagnosis of such cases. Multiple small abscesses are almost necessarily fatal, as they can rarely be evacuated either by natural processes or by surgical intervention. In large abscesses the mortality has been greatly reduced of late by the greater fearlessness and thoroughness with which they are operated on. Operation appears to give much better results in the ordinary septic abscesses than in the amœbic variety.

Out of 88,416 deaths in ten years, in the city of Mexico, 1985 were due to hepatitis. Symptoms are jaundice, increasing in severity; signs of suppuration; compression of portal vein; rarely ascites; liver enlarged, but not the spleen. On section, the liver shows many, sometimes even 200, abscesses filled with a white or yellow-green pus. Mejia (La Sem. Méd., Aug. 27, '90).

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Cases of abscess of the liver usually terminate favorably after rupture into the lungs. T. Glover Lyon (Lancet, Nov. 20, '97).

Treatment. — Apart from surgical means, little can be done, beyond relieving symptoms and maintaining the patient's strength, until the abscess discharges spontaneously or is accessible to the surgeon. Pain and cough are the chief symptoms to be relieved. In cases of rupture into the bronchi, cough is necessary for the removal of the pus, and should not be interfered with unless excessive.

In multiple abscesses and in suppurative pylephlebitis surgical measures are useless unless to open an abscess threatening to rupture. In single abscesses operation may promise fair success, especially in the non-amœbic cases. In cases in which the abscess is discharging through the lung operation should be deferred if the patient's condition is favorable, as some recover spontaneously.

Direct opening of abscess of the liver with the knife causes no danger of peritonitis if done antiseptically. The incision must be free and lead directly to the abscess. It is advisable to make the opening as high as possible. It is useless to suture the liver to the parietal wound. Incision must be made early, and exploratory punctures are indicated as soon as pus is suspected. Chauvel (Archives Gén. de Méd., Aug., '89).

Two cases of abscess of the liver implicating the pleural cavity. Incision evacuated two quarts of fluid. Two large drainage-tubes were introduced, the cavity washed out, and the antiseptic dressing applied. The patient made a prompt recovery. Cabot (Boston Med. and Surg. Jour., Jan. 9, '90).

Following conclusions presented in regard to hepatic abscesses: 1. Pyæmic abscesses do not call for surgical interference. 2. The same observations apply to abscesses resulting from suppurative

phlebitis of the portal vein. 3. Multiple abscesses associated with dysentery or ulceration of the bowels are very unfavorable for surgical treatment. They must, however, be opened and treated on the same lines as the single or tropical abscess. 4. Single abscesses of the liver must, if they approach the surface, be opened. If the abscesses have burst into the lung, pleura, pericardium, peritoneum, or kidney, and the position of the abscess can be clearly determined, it must be opened without delay. If the position of an abscess be only suspected and the patient be losing ground, the liver should be punctured in the most likely situations. 5. Hydatids of the upper and back part of the liver are to be treated upon the same lines. 6. Empyema, pericarditis, and peritonitis caused by rupture of an hepatic abscess or hydatid must be promptly dealt with on general principles. Codlee (Brit. Med. Jour., Jan. 11, 25, '90).

Only 2 per cent. of liver-abscesses open through the thoracic walls. Free incision with resection of a rib is the best method of treatment in these cases, and secures the promptest recovery Raimundo (Rev. de Ciencias Med., Apr. 5, '92).

Case of liver-abscess in which death resulted from failure to maintain free drainage. Neil Macleod (Brit. Med. Jour., Apr. 30, '92).

Abscess following dysentery should always be opened freely as soon as existence has been determined. Incision eight to ten centimetres. Curetting continued with a long curette, employing continuous irrigation until water flows out clear. Hæmorrhage never observed in forty cases reported. Fontan (Gaz. Hebdom. de Méd. et de Chir., Aug. 25, '95).

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An hepatic abscess, when seated in the upper and back part of the right lobe, is best treated by resection of a portion of the ninth or tenth rib, and transpleural laparotomy, the pleura being stitched to the diaphragm in the absence of adhesions. When the anterior portion of the liver is involved, the abscess should be exposed by anterior laparotomy, the edges of the external wound being stitched to the surface of the liver if practicable.

The inner surface of the abscess-cavity should not be scraped; simple injections after incision are quite sufficient and less dangerous. Ricard (Bull. et Mem. de la Soc. de Chir., 1-2, '96).

Seven consecutive cases of hepatic abscess successfully treated by incision. Walter Boyd (Brit. Med. Jour., Aug. 21, '97).

The treatment of liver-abscess should be prompt, bold, and radical. No measure is successful which fails completely to evacuate the abscess and allow free drainage. This can be done with precision and safety only by incision. The line of incision is to be determined by the position of the abscess. George B. Johnston (Med. Record, June 5, '97).

The point of election in liver-abscess is the most dependent part of the collection, or the point showing a tendency to rupture. In absence of this the points of election are just below the ribs, or in the seventh intercostal space in mid-axillary line. In early operations, or before adhesions have formed, it is advisable to open the peritoneal cavity first, and pack it off by gauze, preliminary to opening the abscess. The subsequent management is similar to that of abscesses in general. John G. Cecil (Amer. Pract. and News, Apr. 17, '97).

Tumors of the Liver.

Of these, secondary carcinomata are, by far, the most common. Primary carcinoma, sarcoma, angioma, and lymphadenoma also occur. Myxoma, cystosarcoma, and fibroma are rare forms. Cancer of the liver is met with in about 3 per cent. of deaths from all causes, and in all persons affected with cancer the liver is the seat in 50 per cent. of the cases, the liver being third in order of frequency of internal cancer.

Symptoms.—In many, perhaps half, of the cases of cancerous disease of the liver there are no symptoms by which the disease can be recognized during life. The symptoms of the primary growth usually

overshadow those caused by the liver disease. The stomach is the seat of the primary growth in more than a quarter of all cases; so that symptoms of digestive disturbances are usually prominent, such as loss of appetite, distress after food, nausea, and vomiting. Progressive loss of flesh and strength is an early symptom. Pain and uneasiness in the hepatic region are common, but in many cases of even extensive disease of the liver neither is present. No doubt both are often due to local peritonitis.

In tumors, especially cancers, which have developed at the hilus or under the left lobe, an arterial murmur can be heard all over the organ, due to stenosis of the hepatic artery or to compression of the abdominal aorta. Rovighi (Oesterr-ungar. Centralb. f. d. med. Wissen., June 7, '90).

Case of primary hepatic cancer in which, during life, no symptom of insufficiency of the liver-functions had been observed. Pauly (Lyon Méd., July 15, '94).

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Progressive enlargement in malignant disease is almost invariable. When irregular, the growth is generally secondary. Tenderness and pain is usually experienced. When the growth is deep-seated, pain may be but little marked or absent. Outlying secondary growths may form on the falciform ligament. Gastric derangements are frequent. Hæmorrhages into the skin may occur with or without jaundice. Jaundice and ascites are accidental symptoms. They both occur in about half the cases. In rare cases the ascitic fluid may be chylous. Emaciation of a steadily progressive type is most characteristic. Death often occurs within three months of the onset of symptoms. Cachexia is an important diagnostic sign.

Primary malignant disease of the liver seems to be more frequent in men than in women. Secondary growths are usually carcinomatous. H. D. Rolleston (Clin. Jour., Mar. 3, '97).

The liver is usually enlarged. Hepatic dullness may extend upward to the fifth rib in the midaxillary line, to the left as far as the spleen, and the lower edge may be felt at or below the umbilicus. The lower edge and anterior surface below the costal margin are hard and often uneven on account of the nodular deposits. The nodules in some cases are felt to be umbilicated: an absolutely diagnostic sign. In cases of diffuse infiltration the liver may be very large; occasional instances are met with in which it is smaller than normal. The surface is smooth and hard and usually tender.

Jaundice is present in about half the cases. It is usually slight at first, becoming deeper toward the end. It is usually due to pressure on the common bile-duct in the transverse fissure by carcinomatous glands; it may be due to pressure on the branches in the liver by growing nodules, or if the primary growth is in the head of the pancreas it may press on the common bile-duct. It is important to remember that cancer of the liver is the most frequent cause of long-standing jaundice; it is permanent, and in the later stages may become extremely deep.

Case of cancer in which detached portion caused symptoms of lithiasis; obstruction caused jaundice; glands of hilum gave rise to circulatory symptoms, while consecutive cirrhosis further complicated the case. Gilbert, Claude (Archives Gén. de Méd., May, '95).

Ascites occurs in some cases, and is caused by pressure on the portal vein or to extension of the cancer to the peritoneum. It is present in the cirrhotic form of cancer.

The superficial veins are enlarged. Some fever is not rare, continued or intermittent, especially when the disease runs a rapid course. It may occur in simple cancer, or may indicate suppura-

tion. Hæmorrhages into the skin or from the mucous surfaces may occur late in the disease.

Course and Duration.—Death usually results within a few months; it is rarely delayed beyond a year after the symptoms have declared themselves. Occasionally the progress is delayed for some weeks at a time, during which some improvement may take place in the general condition. Death is usually due to progressive debility, with, in the last stage, some infection that closes the scene.

Case in which cancer developed with great rapidity, causing death ninety days after initial symptom. Bonnevie (Norsk Mag. f. Lægevid., p. 127, '95).

Diagnosis. — The occurrence of progressive loss of flesh and strength, of pain and tenderness in the hepatic region, and of rapid enlargement of the liver, with the formation of nodules, forms a fairly sure basis for diagnosis. Even with this symptom-group, difficulties may beset us.

Case in which cancer was only recognized post-mortem, owing to absence of all usual symptoms. Dupont (Archives Méd. Belges, Sept., '95).

Certain cases of hepatic cancer closely resemble terminal stages of heart disease. But in latter slighter diminution of urea and albuminuria present, whereas absent in cancer, — main differential points. Hanot, Flu (Jour. de Méd. et de Chir. Prat., Aug. 16, '95).

Apparent enlargement of the liver may be due to hardened fæces in the transverse colon, which is tender, owing to the enteritis caused by the hard masses. Indurated puckered omentum and tumors of the stomach, kidney, and the abdominal wall may also simulate a large liver. The large cirrhotic liver may, in the early stage, be mistaken for cancer, as the liver is large and the jaundice usually well marked; but the liver is smooth and not tender and there is absence of the cachexia of cancer. The spleen is also large.

Case diagnosticated as hypertrophic cirrhosis of the liver, which proved at the autopsy to be a case of cancer of the omentum and of the liver. Watkins (Jour. State Med. Soc. of Ark., July 15, '91).

Syphilitic disease in which there is large amyloid liver with gummatous nodules may present some difficulties, as may also echinococcic liver with large cysts. In both, the history is more prolonged and there is absence of cachexia and usually of jaundice. Ascites is strongly indicative of cancer. The early period of cancer with cirrhosis may be indistinguishable from atrophic cirrhosis; there is similar jaundice and ascites in both, but later the cachexia is more marked in the cancerous form.

Melanosarcoma usually involves other organs as well. It may cause great enlargement of the liver. Secondary tumors may form in the skin. In many cases there is melanuria: a characteristic symptom. Great difficulty is often experienced in differentiating cancer of neighboring organs from cancer of the liver, especially if they are adherent to the liver.

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The chief interest in tongue-like accessory lobes of the liver is in connection with the diagnosis of abdominal tumors. Unless fully alive to the great variety, as to shape and position, in which the accessory lobes of the liver may present themselves, one will often be misled. McPhedran (Canadian Pract., June, '96).

In all cases of doubt in neoplasms of the liver, it is advised to explore the hilum of the liver to see if there are any enlarged glands present: if present, they show a metastasis from a malignant growth, and puncture is unnecessary; but their absence does not exclude a

malignant growth, for if it is a secondary growth the metastasis would not be through the lymphatics, but through the venous channels, and the glands would not be enlarged. Primary cancer of the liver shows metastasis in the glands situated at the hilum. Tuffier (Gaz. Hebd. de Méd. et de Chir., Jan. 28, '97).

A very handy and accurate method of recording the size and position of abdominal organs or tumors has been called the Keith method. It consists in first carefully percussing out the organ,—say, the liver. The limits of percussion-dullness are then marked on the skin by black paint (Indian ink). Then with red paint the ribs are mapped out by a broad band drawn on the skin over each rib. When the coloring fluids have dried, a piece of thin, transparent muslin is placed over the front of the body, large enough to cover the body from the clavicles to the pubes. With red paint the red lines over the ribs, the arch of the subcostal angle, the nipples, and the umbilicus are then traced on the muslin, and finally the brush is drawn along the black outlines of the liver as they are seen through the muslin. On the muslin the patient's name and the date of drawing, as well as the disease should be painted for future reference and comparison with note-book. By this method one preserves a life-sized drawing of the liver, and a permanent record. James Cantlie (Clin. Record, June 22, '98).

Etiology.—Cancer of the liver is most frequently secondary to cancerous disease in the organs connected with the portal circulations. Hence it occurs secondarily to cancer of the stomach, rectum, colon, œsophagus, gall-bladder, bile-ducts, and pancreas. It also follows cancer of the uterus and ovaries and the mammary gland.

It occurs usually in late adult life, especially between the fortieth and sixtieth years, but may occur in children. The relative frequency of its occurrence in the sexes is doubtful; some observers state that it is more frequent in males, others in females. My own experience coincides with the former. Inquiry is a doubtful cause and cancer of the bile-ducts is frequently associated with gall-stones, but whether as a cause or a result is uncertain.

Morbid Anatomy. — As the primary growth is situated in some organ whose blood is carried to the liver by the portal vein, the liver becomes early affected, and often is the seat of large deposits at the time of death. The deposits are in the form of whitish nodules scattered irregularly throughout the liver just as we would expect, in view of infection through the blood of the portal vein. The nodules vary in size from a microscopical point up to a mass occupying a large portion of the organ. As they grow in the direction of least resistance they appear early beneath the capsule, and if the abdominal wall is thin they may be felt and even seen through it. They may be firm from fibrosis or soft from degeneration; the former shows umbilication on the surface, owing to contraction of the fibrous tissue. The masses are globular, but coalescence may result in the formation of large irregular masses presenting, on section, a striking contrast to the liver-tissue. Their color may be a bright yellow, from bile-staining; dark-red, due to hæmorrhage; or pale yellow, from fatty degeneration.

The secondary cancers are of the same structure as the primary one from which the infection was derived: usually alveolar or cylindrical carcinoma. The peritoneum over them may be thickened and strong adhesions formed with the abdominal wall or diaphragm. Usually some of the bile-ducts are compressed, obstructing the flow of bile.

Primary Cancer of the Liver.—Of this there are three forms:—

(*a*) A simple large tumor with well-defined boundaries. It is usually grayish

white, but may be the seat of hæmorrhage.

(*b*) *Nodular growths* are the most common, and the whole liver resembles the appearance it presents when it is the seat of secondary carcinoma.

(*c*) *Cancer with Cirrhosis.*—This is a remarkably rare form. In it the cancer-cells are uniformly diffused through the liver; so that the fibrous tissue is increased in all directions. This may contract and cause the liver, which at first is enlarged, to become smaller than normal. The organ looks like a coarse cirrhosis. When cut there are wide white bands seen running through the organ, the gland-tissue between them having vanished. Secondary growths in other parts of the body scarcely ever occur.

Out of 258 cases recorded in the Berlin Pathological Institute from 1880 to 1889, only 6 cases of true primary cancer of the liver found, and of these 2 are doubtful. Hansemann (Berliner klin. Woch., Apr. 21, '90).

Sequence of events in cases of cirrhotic cancer held to be as follows: 1. Cirrhosis with hyperplasia of the liver-cells. 2. The embryonal connective tissue gradually becomes fibrous and the liver-cells are converted into cancer-cells. Fussell and Kelly (Univ. Med. Mag., Aug., '95).

Cirrhotic cancer arises from an hyperplasia of the hepatic epithelium independent of the cirrhosis, although the latter may favor the development of the carcinoma. Siegenbeck Van Heukelom (Ziegler's Beiträge, B. 16, H. 3).

In cirrhotic cancer cirrhosis looked upon as secondary and as a defence of the organism against the cancer. Notthafft (Deut. Arch. f. klin. Med., Aug. 29, '95).

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Case of primary cancer of the liver with secondary cancer of the stomach, periportal glands, pancreas, and vena cava. The mass occupied nearly the entire right lobe of the liver. At no place was it covered by more than two centimetres of liver-tissue. Martin and Hamilton (Montreal Med. Jour., Apr., '96).

Primary carcinoma may be: 1. Massive, more often found in the right lobe, where the liver is expanded like a shell around the growth. 2. Infiltrating, the growth being diffuse, of comparatively slow growth, and so hard as to simulate cirrhosis. 3. Nodular, when the appearance is similar to that due to secondary growths. 4. Carcinoma with cirrhosis. H. D. Rolleston (Clin. Jour., Mar. 3, '97).

Sarcoma.—Two forms occur: primary and secondary. The primary cannot be distinguished at the bed-side from carcinoma, and even after death it is often difficult to differentiate them. The disease is extremely rare.

In case of primary sarcoma of the liver in a child 4 months old there was no icterus, but the abdomen was enormously distended. At the necropsy the liver was found to contain numerous disseminated tumors of a light red-brown. The growth consisted of small round-cells, which seemed to originate from the endothelium of the interacinous blood-vessels and penetrate into the veins, where they compressed the liver-cells. Lendrop (Hosp.-tid., p. 217, '93).

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Case of primary sarcoma of the liver. Increase in the size of the abdomen continued for three months without symptoms, when fæces became black and the urine dark. Later the abdomen increased still further in size and nodules could be felt. He had anasarca downward from the eighth rib and marked ascites. The skin showed slight icteroid discoloration, the thorax was negative, the abdomen was enormously distended, and hepatic dullness commenced at upper border of fifth rib; lower edge of the liver was irregular and could be felt in the neighborhood of the umbilicus. Death occurred as a result of œdema of the lungs. C. von Kahlden (Ziegler's Beiträge, vol. xxi, H. 2, '97).

Secondary sarcomas of the liver exactly reproduce the form of the original

growth. The patient usually dies before any symptoms are produced by them. Melanosarcoma is the most important form; it develops in the liver secondarily to sarcoma of the eye or of the skin. It is very rarely primary. The liver is greatly enlarged, and is affected by uniform infiltration or by nodular black masses. In the former case the cut surface is studded with black or brown granules. There are usually metastases, affecting in some cases every organ in the body. Nodules of melanosarcoma in the skin may guide to the diagnosis. (Osler.)

[Melanuria seems to be so nearly constant a symptom of melanosarcoma as to be of considerable value in the diagnosis of obscure cases. There is good reason to believe that it only appears when metastases have occurred in the internal organs, especially the liver. It is not, however, pathognomonic. F. C. Shattuck, Assoc. Ed., Annual, '90.]

Case of melanotic sarcoma in which liver weighed 13 pounds 10 ounces. Codd (Birmingham Med. Rev., June, '95).

Case in which there was a large liver with pain in the abdomen and delirium. The urine was dark red in color and on standing became darker. It contained some sugar, and upon the addition of Fe_2Cl_6 became black. There was some leucocytosis containing pigment, and there was also some free pigment in the blood. Diagnosis of melanotic sarcoma of the liver confirmed by autopsy. Pickler (Zeit. f. Heilk., B. 17, H. 2, 3).

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Liver-sarcoma tends to assume an alveolar arrangement. Kahlden (Beit. z. path. Anat. u. z. Path., B. 20, H. 2, Jena, '97).

Other Forms of Hepatic Tumor.—Cavernous angioma are common, but produce no symptoms during life. They occur as small, reddish bodies, and consist of dilated blood-vessels. They have produced large tumors in children occasionally.

In man the liver is, perhaps, the most frequent seat of angiomata. Adami (Montreal Med. Jour., July, '94).

Adenomata observed: 1. Post-mortem, in subjects affected with atrophic cirrhosis or rarer disease. 2. In subjects presenting a cirrhosis of extremely-rapid progress, persistent icterus and enlargement of the liver being added to the ordinary symptoms. 3. In cases the symptoms of which do not resemble those of cirrhosis, but of neoplasm. Darier (Bull. de la Soc. Anat., No. 12, '92).

Case of Laennec's atrophic cirrhosis of rapid development accompanied with icterus and associated with adenoma of the liver, occurring in a male. There was extensive œdema and ascites. The spleen was enlarged and diffluent, the kidneys enlarged and congested. Dufournier (Bull. de la Soc. Anat., No. 21, '92).

Case of tubular adenoma of the liver in a man aged 60 years. Death occurred from rupture of the liver. Vanni (Rivista Clinica e Terap., Apr., '93).

Treatment.—As cancer of the liver is invariably fatal, nothing can be done beyond allaying the pain, relieving the gastric disturbance, removing ascitic fluids if excessive, etc.

In animals one-third of the liver may be removed without causing death. Ceccherelli (Wiener med. Presse, May 26, '89).

Removal of the liver in the frog does not involve an immediately fatal tissue, as in the case in mammals. Roger (La Sem. Méd., June 15, '92).

Liver-hæmorrhage is amenable to pressure applied directly upon the bleeding surface, in that regard resembling the kidney. L. McLane Tiffany (Amer. Jour. Med. Sci., June, '88).

Large portions of the liver can be removed without undue disturbance of the function of that organ: the escape of bile into the peritoneal cavity is not a usual phenomenon after such an operation, and it may be generally prevented either by searing the raw surface of the liver, by

ligation, or by securing the stump in the abdominal wound, and even if the bile does enter the peritoneal cavity the result is not necessarily fatal; hæmorrhage need not be greatly feared, as vessels can often be tied separately or *en masse*, cut through by the cautery, or controlled by pressure; resection or amputation is best done either by enucleation, by the cautery, or with the knife or scissors,—preferably, perhaps, in the order named; the mortality thus far has only been about 10 per cent. W. W. Keen (Boston Med. and Surg. Jour., Apr. 28, '92).

Portions of the liver removed by operation speedily replaced and parts renewed perform their function normally; surgeon justified in removing, when necessary, even large portions. Von Bergmann (Archiv f. klin. Chir., B. 46, H. 2, '95).

Case of successful removal of an adenoma connected by a thick pedicle with the lower surface of the liver. Von Bergmann (Brit. Med. Jour., May 27, '93).

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Hæmorrhage forms the serious danger which makes the extirpation of malignant tumors of the liver very perilous. Routier (Univ. Med. Jour., Feb., '97).

As a means of hæmostasis, the temporary digital compression of the pedicle of the liver is proposed. The method of procedure is as follows: The left index finger is introduced through the foramen of Winslow and compression by the thumb of all the structures of the pedicle. Tuffier (Gaz. Hebdom. de Méd. et de Chir., Jan. 28, '97).

In operations on the liver ligature of the mass of the liver, slowly and firmly drawn tight, closes the lumen of the vessels and thus prevents hæmorrhage. After chloroform the peritoneum is opened and the lobe of the liver drawn out through the wound. A row of ligatures is then made through the liver with a blunt needle and a double silk thread, the entire length of the piece to be removed. The needle is passed through the substance of the liver several times, a few centimetres apart. The nearest threads in the different holes are tied together. When these ligatures are drawn tight, the piece to be resected in front or back of them is removed. Compresses of gauze should be applied to control hæmorrhage of the parenchyma. After ablation the hepatic stump is sutured to the end of the abdominal wound, or the great omentum can be sutured to the cut surface of the liver, or the stump can be put back into the abdominal cavity and the walls closed with a suture in three stages, after dressing with collodion gauze.

The most convenient cutaneous incision is parallel to the arch of the false ribs, one or two finger-breadths below, ten to fifteen centimetres in length, starting at the right parasternal line for the right lobe, and at the median line, swerving to the left, for the left lobe. Kousnetzoff and Pensky (Rev. de Chir., Dec., '96).

The best procedure in treating liver-wounds after removal of tumors is to use a rubber tube for a tourniquet, if necessary to tie all large vessels separately, using pressure for the oozing; to close the liver as much as possible with sutures; to drop the stump and to surround it completely with sterile gauze, packing iodoform gauze against the liver-wounds, and leave the abdominal wound sufficiently open to facilitate dressing the liver-wound. Elliott (Annals of Surg., July, '97).

In resection of the liver it is recommended to apply to the liver around the portion to be removed a series of interlocked ligatures of thick silk. Each individual ligature, after being crossed with its fellow to the right and left, is slowly and steadily tied with such firmness that the liver-parenchyma is cut, but the vessels are retained undivided in the loop. When the whole series of ligatures are tied then the vessels are to be severed by the knife or scissors. It is of importance while transfixing the liver to use little force, and when any slight obstacle to the passage of the instrument is encountered, to manipulate the needle from side to side, and so gently guide it past the obstruction.

The points of transfixion ought to be about one centimetre apart. In experiments on dogs no difficulty has ever been met with, and the wound in the liver has

never bled in the slightest degree, either primarily or secondarily.

It might be well in excising portions of the liver to make the wound wedge-shaped, so that, hæmostasis having been obtained by ligatures, the wound might be made less extensive by means of sutures passed from side to side. M. Auvray (Revue de Chir., Apr., '97).

Successful removal of an angioma of the liver by elastic constriction external to the abdominal cavity. W. W. Keen (Penna. Med. Jour., Oct., '97).

Successful extirpation of a large cavernous angioma of the liver. Its origin was from the lower surface of the left lobe by a broad attachment. Pfannenstiel (Allg. Med. Central-Zeit., Feb. 19, '98).

Case in which left lobe of the liver contained a growth. A double temporary ligature of catgut was put around the portion of the liver to be resected. Then, while strong traction was made, a tentative cut was made in the liver. The vessels were drawn and ligated as the resection proceeded. A large piece of the liver was thus resected without any hæmorrhage. A large piece of sterilized rubber tissue was placed on the intestines and a piece of gauze against the raw surface of the liver. These were removed in a few days. The patient's general condition improved markedly. H. Lilienthal (Med. Record, Oct. 22, '98).

Successful removal of an epithelial tumor from the middle of the anterior border of the liver. Use was made of the method advocated by Kousnetzoff and Pensky, consisting of a system of chain ligatures, the tissue of the liver being divided with a thermocautery. Hæmorrhage was in this way almost entirely avoided. The abdominal wound was left open and it rapidly graduated. Terrier (Med. News, Jan. 15, '98).

Hydatid Cyst of the Liver.

Symptoms.—Small cysts cause no symptoms; they may be discovered at the autopsy. Cysts may reach considerable size without causing inconvenience and be discovered as a tumor-like enlargement accidentally. The liver enlarges irregularly and in time the cyst causes disturbance by pressing on some neighboring organ or part, interfering with its function. If in the dome of the liver it may displace the heart or lungs. It may press on the bile-passages, jaundice resulting; or on the portal vein, causing ascites. If it presses on the vena cava it causes œdema of the legs. If superficial, the cyst may fluctuate to palpation, or, if tense, it may be felt as a hard solid mass. *Hydatid thrill* is sometimes obtained by placing one hand lightly on the cyst and tapping it gently with the fingers of the other hand. The thrill has been ascribed to the sudden impact of the daughter-cysts against each other and against the wall of the cyst; but thrill is sometimes obtained in cysts which contain only clear fluid.

Rupture of the cyst may occur. If it takes place into any of the serous cavities inflammation results. The pleura suffers most frequently; perforation of the lung often follows, with pneumonia and the expectoration of cysts and hooklets. More often pus, blood, and bile-pigment are coughed up, such as occurs in gangrene or abscess of the lung secondary to liver-abscess.

The cyst may rupture into the stomach, as proved by the vomiting of cysts and hooklets; or into the intestine, with the appearance of these bodies in the fæces, as would occur also if rupture takes place into the bile-passages. Rupture may occur into the pelvis of the right kidney followed by the presence of the hooklets and cysts in the urine.

Cases of hydatid cysts in which cyst opened through gall-bladder. Brjuchanow (Bolnit. Gaz. Botkina, No. 2, '95); Medwedjewa (Bolnit. Gaz. Botkina, No. 2, '95).

Case of hydatid cysts in which cyst opened into bladder. Heneczynski (Münch. med. Woch., Mar. 26, '95).

Case of hydatid disease of the liver, with perforation of one of the cysts into the stomach. Karmilow (Laitopisj Chir. kago obschtschestwa, No. 3, '92).

Hooklets are frequently absent from hydatid tumors. James Watson (Lancet, Dec. 3, '92).

Case of cyst in the liver containing 10 quarts of liquid. Microscope showed no traces of echinococcus and no bile-salts or pigment. There was no epithelial lining of the cyst. Boyer (Amer. Jour. Med. Sci., May, '93).

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Case of ileus due to hydatid cyst of the liver. Reichold (Münch. med. Woch., Apr. 27, '97).

Apart from such accidents, the symptoms may consist only of trifling discomfort in the hepatic region.

Rupture of the cyst is often followed by severe urticaria; it has been attributed to a toxic material in the fluid. It may also follow aspiration of the cyst.

Diagnosis.—This is rarely possible before the cyst has attained considerable dimensions; then the irregular enlargement of the liver for a long period, with the preservation of health, indicates hydatid disease. It may be necessary to aspirate the cyst, and, if hooklets are found in the fluid, the diagnosis is confirmed. A fluctuating tumor in the epigastrium is suggestive; it may give fremitus and be within easy reach of the aspirator-needle. Abscess of the liver is differentiated by the absence of symptoms of suppuration. It will not be possible to distinguish a suppurating hydatid cyst unless the hooklets be found in the fluid. Cancer has been closely simulated by suppurating cyst. The clinical history usually serves to differentiate it. Dilated gall-bladder and hydronephrosis have been mistaken for hydatid cyst. A more common error is the mistaking of a cyst of the dome of the liver for right pleural effusion. Subdiaphragmatic abscess, and purulent pleurisy secondary to rupture of a cyst are conditions difficult or impossible to distinguish unless the hooklets are found in the fluid.

In hydatid cysts of the liver a preliminary puncture with the aspirator should always be performed, as it establishes the diagnosis and may effect a cure. In subdiaphragmatic hepatic cysts the transpleural incision with costal resection at one and the same time should be the operation preferred. Ségond (Lancet, Apr. 14, '88).

Peculiar symptom observed in two cases of hydatid which is believed to be of great value in the diagnosis of impending or actual perforation of the cyst. It is a highly characteristic aromatic odor, resembling that of boiled plums. Eichhorst (Zeits. f. klin. Med., B. 17, Supplement H, '90).

Resounding sign described by Santini a valuable diagnostic point. Uniform in single cyst, varying when a number present. Fiaschi (Australasian Med. Gaz., Aug. 20, '95).

A new physical sign for hydatid cysts consists in the development of a peculiar sound on combined auscultation and percussion. Rovighi (Policlinico, No. 11, '94).

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In diagnosis between echinococcic cyst of the liver pointing upward and pleurisy with effusion the complete absence of the breath-sounds and the occurrence of pains beneath the shoulder-blade are significant points. In pleurisy the heart is pushed to the left, in hydatid cysts to the left and upward. Sometimes an elastic resistance may be felt and fluctuation occasionally occurs. Cardarelli (Giorn. Inter. delle Sci. Med., Feb. 29, '96).

The term hydatid is applied to the bladder-worms, which are the larval forms of the *Tænia echinococcus*: the minute tape-worm of the dog family. When fully grown the parasite is not

more than four millimetres, or one-sixth of an inch, long. It consists of four segments, of which the last alone has fully-formed sexual organs. It is very common in dogs of Iceland and Victoria (Australia); also in the Icelandic settlements in Manitoba (Canada), the dogs having been brought from Iceland. The ova of the echinococcus are expelled with the excrement and find their way into the alimentary canal of man by water and green vegetables; also by direct contact with infested dogs, to the hair of which ova adhere and may be carried to the mouths of those who touch the dogs. The disease is rare in Canada and the United States, as well as in European countries, because the dogs are rarely infested, else, of necessity, hydatids would be of frequent occurrence among all classes, irrespective of habits as to cleanliness.

Morbid Anatomy.—The ovum, having entered the human stomach, loses its covering by digestion, setting free the larva, which, by its hooklets, burrows through the intestinal wall. Some of them meet with and enter a branch of the portal vein and are carried to the liver, where they lose their hooklets, and their cystic development begins. The cyst contains a clear non-albuminous fluid inclosed in a capsule of two layers. There is an outer, thick, homogeneous, laminated, elastic membrane which coils upon itself wherever cut and if withdrawn displays a tremulous motion. This is the *ectocyst* of Huxley. Within and closely in contact to this lies the *endocyst*: a delicate, thin, soft, granulated membrane, forming the vital part of the bladder-worm. Outside the capsule there is usually a thick investment derived from the tissues of the infested organ. After the cyst has attained considerable size buds are produced from the inner membrane which gradually develop into cysts having the two walls identical with the parent-cyst. From these daughter-cysts similar buds develop and from a tertiary series — the granddaughter-cysts, and so on indefinitely. In time each of these cysts severs its attachment to the parent and becomes independent. From the inner membrane or endocyst of all these cysts buds arise and become transformed into scolices, or echinococcic heads, presenting a circle of hooklets and form sucking disks. Each of these, transferred to the intestine of a dog, may develop into a tape-worm. The exact manner of the development of these buds is in dispute. It is thus apparent that there is a striking contrast between the development of this parasite and of the *Tænia solium*. The ovum of the latter develops into only one larva capable of producing only one tape-worm, while the ovum of the *Tænia echinococcus* produces a larva capable of multiplying itself indefinitely, so that from it an innumerable number of tape-worms may result.

The hydatid cyst is usually single, the daughter-cysts being in the cavity of the mother-cyst, which may be of enormous size, filling the abdomen and pushing the diaphragm high into the thorax. The liver-tissue is atrophied in proportion to the size of the cyst; that is, the pressure to which it is subjected. The parasite may die. Then the fluid becomes absorbed, the capsule shrivels, and within its remains are found fat-drops, cholesterin crystals, and hooklets. The capsule may become inflamed and an abscess result.

In lower animals the cyst may be multiple, the daughter-cysts developing outward from the mother-cyst: exogenous.

A third form is multilocular. In this

the daughter-cysts are surrounded by fibrous tissue and all become consolidated into a multilocular mass resembling a colloid cancer, for which it was formerly mistaken.

Prognosis.—Hydatid cyst of the liver is a serious disease, proving fatal in about 25 per cent. of the cases. The course of the disease is chronic, sometimes lasting as long as thirty years. Recovery may follow death of the echinococcus, which occurs occasionally, possibly from escape of bile or blood into the cyst. As a rule, the cyst ruptures on account of its continued increase in size. The rupture may take place into the peritoneal cavity and is usually fatal from shock; the fluid, being sterile, does not cause peritonitis. If inflammatory adhesions to the colon, stomach, small intestine, or right kidney have preceded the rupture, the cyst may rupture into one of these organs, with discharge of the fluid by vomiting, diarrhœa, or with the urine. If the cyst is situated in the dome of the liver it may rupture into the pleura or pericardium. The latter is fatal, but recovery may follow discharge through a bronchus. Rupture may occur into the hepatic vein, or the vena cava and cause sudden death. The cyst may open into the bile-passages and recovery follow, although grave symptoms usually result from obstruction and secondary infection.

The most favorable result is by adhesion to the abdominal wall and perforation externally, usually near the umbilicus. The cyst frequently suppurates, pyogenic organisms gaining access to the cavity by the blood or bile, or from a neighboring inflammatory focus. As in abscess, the pus here also is said to be usually sterile.

Treatment. — Operation alone offers hope of relief, and brilliant results have followed such intervention. The simplest operation consists in aspiration, and is frequently successful. If not successful, injection of antiseptic fluid should be resorted to. Various antiseptics have been recommended, the last of which is probably silver-nitrate solution (1 to 500). It is said to act by precipitating the chlorides and leading to the death of the parasite.

Five cases of hydatid cysts treated by incision with but 1 death. In 10 other cases after completely emptying the cyst, 1 teaspoonful of a solution of sublimate 1 to 1000 was injected. 8 cures being obtained. Bouilly (Med. Press and Circular, May 4, '92).

Sudden death of a child of 5 years following the injection of glycerin solution of bichloride of mercury into an echinococcic cyst. The autopsy revealed a perforation of the cyst-wall through which the liquid had passed into the peritoneal cavity. Félizet (Le Bull. Méd., Feb. 26, '93).

Aspiration performed only in cases of simple cysts of the liver without daughter-progeny, and in those that have not suppurated. Reference made to Davies Thomas's statistics,—411 tapping-operations on liver-cysts: 73 died, 5 not relieved, 92 failed to cure, 68 relieved, 163 reputed cured, and 10 cases result unknown. Alexander H. Ferguson (Annual, '94).

Statistics of abdominal section for hydatid of the liver show extremely favorable results.—68 cases, with 7 deaths,—within a fraction of 90 per cent. of recoveries. The method of operation by two stages, producing peritoneal adhesion by incision and packing with carbolized gauze, showed a mortality of a fraction over 19 per cent.; the operation by caustics gave a mortality of 33.68 per cent., while that by *canule à demeure* was 26.66 per cent. Thoracic incisions for hydatids of the liver occupying the convexity of the organ show a high rate of mortality. Where an hydatid cyst of the liver has ruptured into the pleura, free incision into the pleural cavity appears to be the

only treatment which holds out a fair promise of success. Thomas (Brit. Med. Jour., Sept. 28, '89).

Literature of '96-'97-'98.

Method of Baccelli, which consists of injection into the cyst of 20 cubic centimetres of distilled water containing 0.02 gramme of corrosive sublimate after the withdrawal of 30 cubic centimetres of the liquid, should be practiced in the treatment of echinococcic cysts before a formal operation is undertaken. Stefanile (Riforma Med., No. 76, '96).

The true surgical treatment of hydatid cysts of the liver consists in direct incision made by the anterior abdominal route, by the transpleural route, or by the lumbar incision. Median or lateral laparotomy should be reserved for antero-inferior or antero-superior cysts. The transpleural route with resection of the ribs is the best way of reaching subdiaphragmatic cysts which are deeply placed. Lumbar incision allows the surgeon to reach cysts in the posterior and lower part of the liver. Bolognesi (Bull. Gén. de Thér., Mar. 30, '96).

In hydatids of the liver: an incision over the most prominent part of the mass should be made, if a mass can be detected; but, if no tumor is obvious, the guide to incision is the area of hardening and of dullness on percussion. They should be produced by suturing the peritoneum around the mass. The aspirator is used to prove diagnosis, always bearing in mind the possibility that typical fluid will not appear, as it may be too thick to enter the needle. When it has been found necessary to produce adhesions artificially the surgeon waits for several days before opening the cyst. The opening made in the cyst-wall should be of sufficient size to admit a large-sized drainage-tube. The dressing must be conducted with the strictest antiseptic care. For the first week after operation the cyst-cavity should be washed out with sterile water, after this with carbolic solution, iodine solution, or any of the antiseptic solutions. J. Frank (Amer. Jour. Med. Sci., Oct., '96).

In resection of the liver for echinococcus stress laid on the value of a preliminary ligature passed through the whole substance of the liver, so as to keep the organ well in the abdominal wound. Palleroni (Gazz. degli Osped., Aug. 7, '98).

Free incision and drainage are being resorted to more frequently of late, and with results that justify such radical means.

Electrolysis and potassium iodide have been successful in a few cases.

Amyloid Liver.

Symptoms.—There are no characteristic symptoms of amyloid liver. The patient presents the symptoms of the primary disease to which the amyloid change is due. He is pale, cachectic, and later may be dropsical. There is no jaundice or bile-pigment in the urine. Bile is secreted and flows into the intestines, coloring the contents. There is disturbance of digestion and often diarrhœa, on account of the amyloid deposit in the intestine. The urine is usually copious, pale, of low specific gravity, and contains much albumin on account of the amyloid disease of the kidneys.

On physical examination the liver is found large, firm, smooth, and not tender. Its lower edge is usually rounded, but sometimes sharp, and not rarely as low as the iliac crest. There are no signs of portal obstruction. The spleen may be large, on account, chiefly, of the amyloid change in it.

Course and Duration. — The general condition grows gradually worse, the surface becomes an earthy pallor, which, some believe, is characteristic, and the patient dies from exhaustion, if not cut off by an intercurrent affection or a "terminal infection."

The duration of the disease is usually several years, although occasional cases run their course in a few months.

Diagnosis.—This is usually easy from

the associated conditions. The occurrence of progressive enlargement of the liver in a case of long-standing suppuration, especially of a tuberculous or syphilitic character, renders the diagnosis almost certain. The co-existence of degeneration of the kidneys, spleen, and intestines adds to the certainty of the diagnosis.

Etiology.—In amyloid liver a deposit of waxy material takes place in the blood-vessels and interstitial tissue of the liver. It occurs as part of a general degeneration in certain constitutional conditions of which prolonged tuberculous suppurations of the bones, lungs, and urinary tract are the most frequent. Next to these, syphilitic suppurations are the most common causes; but the amyloid change may occur in syphilis without suppuration. It is also occasionally found in rickets, Bright's disease, leukæmia, malignant disease, and in protracted convulsions from infectious fevers.

Morbid Anatomy.—In advanced stages the liver is greatly and uniformly enlarged. Its size may be doubled and its weight more than trebled. The surface is smooth, firm, and of a slightly glistening yellowish-gray color. On section the surface has an anæmic, waxy appearance, is semitranslucent in thin sections, and the infiltrated areas stain a rich mahogany-brown on the application of a dilute solution of iodine, while the normal parts become a light yellow.

The morbid change usually affects the capillaries in the middle zone of the hepatic lobules first, and later the interlobular vessels and connective tissue. In the capillaries "the amyloid substance lies between the endothelium and the liver-cells, and the latter atrophy apparently because of the pressure which the amyloid substance exerts. Some of the cells show fatty and albuminous degeneration" (Thoma).

Similar changes are usually found in the spleen, kidneys, and mucous membranes of the intestines.

Prognosis. — The prognosis is bad. Many, however, claim that a cure is possible in the initial stage if the cause is removed.

Treatment. — There is no effective remedy for the disease known; therefore the treatment should be prophylactic.

Tuberculous disease of bones should be treated surgically and cured as soon as possible, as should also chronic suppurations of all kinds. Syphilis should be vigorously treated. The patient should be nourished and the strength maintained as well as possible.

Fatty Liver.

Fatty liver occurs under two forms: fatty infiltration and fatty degeneration. The former represents a normal condition, since liver-cells always contain some minute globules of fat. In this form the particles of fat penetrate the liver-cells, where they coalesce into growing droplets and push aside the cell-protoplasm and often destroy it by interfering with its nutrition.

In fatty degeneration there is a conversion of the protoplasm itself of the cell into fat probably by the action of some toxic agents, such as phosphorus.

Fatty Infiltration.

Symptoms.—There are no distinctive symptoms. The liver may, if large, be felt to be smooth, soft, not tender, and with rounded edges. There is no jaundice. Addison long ago drew attention to a semitransparent, pale, smooth, soft skin, feeling like softest satin, occurring in fatty liver. He considered it almost pathognomonic. And Hebra noticed a similar condition of skin in habitual

spirit-drinkers, and in them fatty liver is common.

Diagnosis.—The fatty liver can usually be recognized by its soft, smooth character and its occurring in the obese or the emaciated. The large amyloid liver is distinguished by being firm, larger, and by the history of the cause and the evidence of renal disease.

Etiology. — The conditions under which fatty infiltration occurs may be divided into two main classes, strikingly in contrast with one and other. In one class the fatty liver results from dietetic errors, from eating an oversupply of rich food, and as a part of general obesity, chiefly in persons of sedentary habits. The blood is overcharged with fat, of which much is stored in the hepatic cells.

> Phloridzin produces fatty liver under certain conditions. Dogs were kept without food for five days; then on the sixth and seventh days 2 ½ drachms of phloridzin were given. The animals were killed on the eighth day, forty-eight hours after the first dose of phloridzin. Well-marked fatty liver was found. The liver of dogs kept without food for seven days contained 10 per cent. of fat, while, if phloridzin had been given the amount of fat was 25.3 to 74.5 per cent. The fatty condition of the liver produced by phloridzin alone did not occur if the animal was fed on nitrogenous and saccharin food, but fatty food increased the fatty infiltration of the liver. (Zeit. f. klin. Med., B. 28, H. 3, 4.)

The other class consists of cachectic cases, of which pulmonary phthisis furnishes the greater number. In these, on account of the low powers of oxidation, even the small amount of food that is taken is not properly oxidized and much of it is converted into fat and deposited in the liver-cells.

Morbid Anatomy.—The liver is large, smooth, and soft. It may weigh ten or twelve pounds. The edge is thick and rounded. The deposit of fat begins in the cells at the periphery of the lobule, and in time distends them. It can be extracted from the cell with ether, leaving the cell shrunk.

The specific gravity of the liver is reduced, so that the whole organ floats when placed in water.

Prognosis.—This will depend on the cause. If the condition that leads to the deposit of fat in the liver is relieved the further deposit of fat will cease and the hepatic cells will gradually be restored to their normal condition.

Treatment.—Treatment should, therefore, be directed to the cause of the condition. In the obese there should be a careful regulation of diet, with a view to lessening the formation of fat while sustaining the strength. Habits of early rising and active exercise should be encouraged, care being taken not to induce overfatigue, especially if the heart shows signs of weakness, as it often does from fatty infiltration or degeneration. Water should be freely taken on an empty stomach, and occasional purging resorted to. Little, if any, alcoholic stimulants, especially beer, should be allowed. If sufficient active exercise cannot be taken, massage and resistance movements will, to a great extent, supply its place.

In the anæmic form of fatty liver, such as occurs in pulmonary phthisis, the treatment should aim at improving the general condition without regard to the liver.

Fatty Degeneration. — This results from poisoning of some form, as in acute yellow atrophy, in which the liver-changes are typical of fatty degeneration

Inflammation of the Bile-passages and Gall-bladder (Angiocholitis or Cholangitis and Cholecystitis).

Definition.—This consists in an inflammation of the biliary tract. It may affect the common bile-duct and all its

branches or any part of them, the cystic duct, or the gall-bladder.

Symptoms. — Since catarrhal cholangitis nearly always follows gastro-enteric catarrh, the usual acute dyspeptic symptoms precede those due to the disease of the bile-ducts; such as anorexia, belching of gas, epigastric distension, nausea, vomiting, and constipation. These symptoms may, however, be very mild, or most of them may be absent, and jaundice be the first symptom noticed. The jaundice deepens rapidly, but is always of a bright-yellow tint, never the green or bronzed hue of that due to malignant disease. The stools are clay-colored and the urine contains bile-pigment. The temperature may be slightly elevated. The pulse is usually normal, but may be slow, being only 40 or 50 to the minute. A dull, heavy, sleepy condition may be present. The liver is sometimes enlarged and palpable below the costal margin.

If the catarrhal inflammation is confined to the gall-bladder the cystic duct usually becomes obstructed by pressure of the bladder-contents on the outlet. No jaundice occurs, or any of the foregoing symptoms, except a sense of pressure and sensitiveness at the seat of the gall-bladder. When distended, it may, if the abdominal wall is lax and not too thick, be felt as a pear-shaped mass adherent to the liver and moving with it.

In suppurative cholangitis the symptoms are usually severe, but may be latent, especially if the disease occurs in the course of an acute infectious disease. There is, in most cases, a previous history of gall-stones. The patient usually suffers from irregularly recurring chills, with fever and sweating, the temperature rising to 104° F. or more. There is swelling and tenderness of the liver. Jaundice is always present, but more variable than in the catarrhal variety; it may be intense. Leucocytosis occurs and is suggestive of the condition. Later the case presents the appearance of a well-marked general pyæmia with emaciation and weakness.

In chronic catarrhal angiocholitis the symptoms may be very characteristic. The jaundice may vary if the degree of obstruction alters, as it often does when a gall-stone is situated in the diverticulum of Vater, where it may act as a "ball-valve," producing complete obstruction as it moves into the outlet of the duct, and, again, allowing bile to pass as it moves back into the diverticulum. In chronic angiocholitis there are often recurrent attacks of fever with chills and sweating, the so-called intermittent hepatic fever. Such cases may have a history extending through some years. It is probably to this class belong the cases regarded as suppurative cholangitis with a prolonged history and ultimately terminating in recovery.

Diagnosis.—In acute catarrhal cholangitis the diagnosis is usually easily made from the digestive disturbance and gradual onset of the jaundice. Gall-stones are excluded by the absence of colic and the fact that the jaundice is not of sudden development. In catarrhal cholecystitis there is enlargement of the gall-bladder, which may be palpable as a pyriform tumor adherent to the liver and rising and falling with respiration. Not infrequently a tongue-like lobe of the liver is mistaken for a distended gall-bladder. So may also a movable kidney; it is usually more easily displaced, and is not attached to the liver. Instead of being smooth, rounded, and elastic, the distended gall-bladder may, from inflammatory thickening, appear more like a solid tumor and be mistaken for cancer in this situation, but

cancer is usually associated with jaundice and cachexia. Echinococcic cysts have also to be excluded; aspiration may be necessary to do so. The history and shape of the tumor may be sufficient to differentiate between the two conditions.

The diagnosis of suppurative cholangitis is to be made by a history of gall-stones, the occurrence of a septic condition with enlargement and tenderness of the liver, and the existence of leucocytosis. There is progressive loss of flesh and strength. The duration rarely exceeds a few weeks, the cases lasting months and ultimately recovering being most probably cases of chronic catarrhal cholangitis due to obstruction, and causing intermittent hepatic fever.

Etiology.—Inflammation of the bile-passages usually results from extension of an inflammatory process from the duodenum, and is, in the majority of cases, associated with gall-stones. The duodenal catarrh that precedes the cholangitis usually follows acute indigestion. The young are most susceptible to it, but it may occur at any age. It occurs also as the result of exposure to cold, chills, malaria, typhoid fever, pneumonia, and in the course of Bright's disease, chronic heart disease, emphysema, etc. It may occur in the course of any organic disease of the liver, as inflammation, cancer, and hydatids. Chronic catarrhal cholangitis may possibly be a sequel to the acute. It is always due to obstruction of the common bile-duct from gall-stones, stricture, pressure from without, etc. The obstruction may be complete, in which case the ducts are greatly dilated and filled with clear, watery fluid similar to that of dropsy of the gall-bladder. If the obstruction is incomplete, there is less dilatation of the ducts, and, as some bile filters through, their contents are bile-stained and turbid. The gall-bladder is not much dilated in these cases, obstruction of the cystic duct being necessary to cause great dilatation of it. Gall-stones are usually found in it.

Suppurative cholangitis is usually associated with gall-stones, less frequently with echinococci and round worms. The mucosa, injured by such foreign bodies, becomes more susceptible to invasion by pyogenic organisms, and these are present normally in the intestines and in the lowest part of the common bile-duct.

Morbid Anatomy.—In acute catarrhal cholangitis the lower part of the common bile-duct is usually chiefly, and may be the only part, affected. The inflammation may extend to its larger branches. Post-mortem evidences are slight, as redness and swelling disappear after death. A plug of inspissated mucus may fill the diverticulum of Vater and completely obstruct the flow of bile. The gall-bladder, when affected, contains a more or less viscid mucous secretion; if there is obstruction of the cystic duct, the bladder becomes distended with fluid, of which it may contain one or more pints, usually thin and without bile. The walls of the gall-bladder are thin and shining; but, if the obstruction persist, they may become much thickened.

In suppurative angiocholitis the common duct becomes greatly dilated and its walls much thickened. Similar changes occur in the gall-bladder. Both are distended with pus. Ulceration may occur and perforation into the stomach, colon, or duodenum, or even into the urinary or respiratory tract. The intrahepatic bile-ducts may be distended with pus,—which is usually bile-stained. The suppurative process may extend to the hepatic substance, resulting in abscess-formation, or to the portal vein, and pylephlebitis result.

The bacteria present in these inflammatory processes are very various. The bacillus coli communis probably plays the most important part, but staphylococci and streptococci are also common, as they are all present in the duodenum in health. The pneumococcus and the typhoid bacillus may be the active agents.

Treatment.—This consists in measures to relieve the gastro-duodenal catarrh. Plenty of liquids should be taken, especially the alkaline mineral waters. The bowels should be moved freely, but not immoderately, by the use of calomel followed by salines, such as Carlsbad salts, phosphate of soda, etc. Bicarbonate of soda, with bismuth, may prove useful for the gastric disturbance. Such antiseptics as resorcin, guaiacol-carbonate, and salicylate of bismuth are useful. A large cold, rectal enema may be given daily; it is said to stimulate contraction of the gall-bladder and ducts and thus promote expulsion of the mucus that is obstructing the escape of bile. The water is to be retained so as to furnish more liquid for excretion, but it cannot effect that object better than water taken by the stomach.

Light liquid diet only should be given, as it is easy of digestion and less apt to ferment.

Tumors of the Biliary Tract.

Cancer.

Etiology.—Cancer may occur as a primary disease of the gall-bladder and of the bile-ducts or may be secondary to cancer of the liver, stomach, pancreas, or peritoneum.

Primary cancer of the gall-bladder affects females much oftener than males—in the ratio of 3 or 4 to 1. The bile-ducts are affected about equally in the two sexes. The disease occurs usually from forty to seventy, but occasional cases are met with in early life and at advanced age.

Gall-stones are present in practically all cases of cancer of the gall-bladder. The relationship between the two conditions is in dispute. Some regard the cancer as developing in the glands of the mucosa on account of the irritation by the calculi; while others look upon them as formed subsequently to the commencement of the cancer. The greater frequency of occurrence of gall-stones in females gives support to the view that their irritation frequently excites the development of cancer.

> Attention called to the frequency with which cancer and biliary lithiasis are associated. Of 44 cases of mammary cancer in females, gall-stones were found in 16 per cent.: a ratio twice as high as that stated to hold for women dead of causes other than cancer. Williams (Brit. Med. Jour., Aug. 26, '93).

The disease usually begins at the fundus of the gall-bladder, and at either extremity of the common bile-duct.

Cancer of the Bile-ducts.

Symptoms.—It rarely forms a tumor that can be felt through the abdominal wall. The jaundice usually occurs early, and is intense and persistent. The stools are persistently clay colored. A fatal termination usually follows in three or four months, from cholæmia. It may be the cause of cholangitis with intermittent hepatic fever or there may be suppurative cholangitis.

Diagnosis.—It is practically impossible to make a positive diagnosis without an exploratory operation. The persistent intense jaundice is suggestive, and may, in some cases, render the diagnosis extremely probable, especially in the absence of biliary colic.

Morbid Anatomy.—The cancer usually develops in the circumference of the duct as an infiltration of the submucous

tissue. The surface of the deposit may be smooth or ulcerated. They occur most frequently in the diverticulum of Vater and may extend to the duodenal papilla.

The epithelium of the bile-ducts may be the seat of the primary focus of carcinoma of the liver. Dallemange (Jour. de Méd., de Chir., et de Pharm., lii, No. 25, '94).

Cancer of the Gall-bladder.

Symptoms and Signs.—Not rarely the attention is first arrested by the accidental discovery of a smooth, firm, egg-shaped swelling below the costal margin. It is fixed to the liver and moves with it in respiration. There is usually a sense of discomfort and later often of irregular pain in the neighborhood of the mass. The pain is rarely persistent or severe, and may disappear altogether. It is usually worse at night and may extend around to the back. Later, as the tumor enlarges, it becomes less defined, and nodules often appear on its surface. If dissemination has occurred, nodules may be felt on the liver and in the peritoneum. Ascites may result from the peritoneal affection or from pressure by diseased lymph-glands on the portal vein in the hilum of the liver. Jaundice occurs in probably not more than half of the cases; when it occurs it is a late symptom and depends on pressure on the bile-ducts in the hilum.

There is usually early general failure of health. In the later stages there is marked cachexia, and loss of flesh and strength, with, not infrequently, mental weakness and a prolonged period of subdelirium. Adhesions to the intestines may give rise to symptoms of partial or complete obstruction.

The course is usually rapid, death occurring in a few months after the appearance of the tumor.

Diagnosis.—The presence of a tumor and the progressive character of the local and general symptoms of the disease usually suffice for a diagnosis. In the absence of a tumor the diagnosis is difficult and may be impossible, as it may be also to distinguish a tumor formed by matted intestine from local peritonitis from a tumor of the gall-bladder. Even incision and exploration not rarely fail to clear up the difficulty.

Tumors of the pylorus, of the transverse colon, of the kidney, and of the suprarenal gland may simulate tumor of the gall-bladder.

Tumors of the biliary passages, or located in the neighborhood of the liver, may give rise to *ballottement*, simulating that obtainable in certain kidney affections. Dentu (Le Bull. Méd., Feb. 12, '93).

Morbid Anatomy.—The cancer may begin at the fundus or near the cystic duct, but often the walls of the gall-bladder are found uniformly thickened. The diseased gall-bladder may form a large, smooth or nodular mass adherent to the liver and to the intestines, and in the centre of the mass a considerable cavity filled with opaque gray fluid containing much flocculent material and several gall-stones. The cancer is usually a cylindrical epithelioma, but it varies much. It may extend into the liver directly or by way of the portal fissure, where it may affect the portal vein and give rise to multiple deposits in the liver. The lymph-glands in the hilum of the liver are usually affected.

Treatment.—Symptomatic treatment is usually all that can be carried out. If the disease is recognized early before it has affected neighboring structures cholecystectomy may be practicable. Mayo Robson reports such a case in which he removed a large portion of the right lobe of the liver with the gall-bladder. The

patient made a good recovery. Other similar cases have been lately reported.

Other tumors of the bile-ducts are rare. Fibromata have been met with. Adenomata occur occasionally. I met with one of the diverticulum of the common duct in a man aged 50 years. A gradually-increasing jaundice was the first symptom. Later suppurative cholangitis occurred, with chills, high fever, and tender liver. At the autopsy the mass in the duct was found to act like a ball-valve, obstructing the discharge of bile.

> There may exist true adenomata of the bile-ducts in livers otherwise little altered, and these adenomata may undergo cystic dilatation; they are of a benign nature, not giving rise to metastasis and, unless considerable extension takes place, they may not give rise to any clinical manifestation. Von Hippel (Virchow's Archiv, No. 3, '91).

Acute Empyema of the Gall-bladder (Acute Infectious Cholecystitis; Acute Phlegmonous Cholecystitis).

Symptoms.—The onset is usually sudden, with pain in the right side of the abdomen in its upper part, but, as in appendicitis, the pain may be general over the abdomen. Nausea, vomiting; a rapid, feeble pulse; thoracic breathing, rise of temperature, prostration, distension, and tenderness of the abdomen are the chief symptoms. In the cases in which the disease is circumscribed local tenderness soon becomes more marked. Jaundice is not usually present. Intestinal symptoms may be marked and not infrequently lead to a diagnosis of acute intestinal obstruction.

Diagnosis.—This is often impossible, especially in the fulminating cases. It is most often confounded with gangrenous appendicitis. In the less severe cases the signs of local disease—as pain, tenderness, signs of exudation, abdominal tension, etc.—may be sufficient to distinguish between the two diseases, unless the appendix is situated abnormally high.

Perforation of the stomach, the duodenum, the colon, the gall-bladder, etc., usually causes greater collapse at first and less marked septic symptoms later.

Etiology. — Acute empyema of the gall-bladder is a rare disease. Cases have been reported from time to time during the last few years. In about 75 per cent. of cases it is associated with gall-stones. It is doubtless due to infection by bacteria which may gain access by way of the blood or the bile. The typhoid bacillus, the colon bacillus, the pneumococcus, and the staphylococcus are the organisms most frequently present. Quite a large number of cases have followed typhoid fever, in some instances months after convalescence.

A comparison has been drawn between the causation of this disease and of appendicitis, the gall-bladder affection being of less frequent occurrence on account of its ampler blood-supply.

Morbid Anatomy.—The gall-bladder is distended, but not large, not containing more than a few ounces of muco-pus. There is a strong tendency to gangrene, proportioned to the virulence of the infection and the tension of the organ. The course is rapid, usually within four or five days. Adhesions are early formed to the intestines, omentum, etc. Later, perforation may occur and abscess result, or an abscess may form without perforation. In the severe cases general peritoneal infection is liable to occur. The contents of the gall-bladder may be very fœtid.

Treatment.—Acute empyema of the gall-bladder is so rapidly fatal that only prompt measures are successful. As in phlegmonous appendicitis, so here prompt surgical treatment is necessary.

The real difficulty is in making the diagnosis. In the early stage care should be taken not to obscure the symptoms by the undue use of opium. The temporary measures should consist in absolute rest, hot applications, complete abstinence from food, water only being given by the mouth, and relief of symptoms as far as possible until the necessity for operation is established when the gall-bladder, if there is empyema or gangrene of it, should be incised and drained or removed. In milder cases, in which the disease is localized, it is probably wiser to delay operation until the disease has been well circumscribed by the inflammatory process, when incision and drainage may be carried out and gall-stones, if present, removed.

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LOBAR PNEUMONIA. See PNEUMONIA.

LOBELIA.—Lobelia is the dried leaves and tops of the *Lobelia inflata*, or Indian tobacco, a weed indigenous to the United States, collected after a portion of the capsules have become inflated. It is a small herb, with alternate leaves, an erect hairy stem, with blue flowers in the axils of the leaves. The herb has a slightly-irritating odor, and a burning, tobacco-like taste. It contains a liquid alkaloid, lobeline, and an acid, lobelic acid; gum resin, fixed oil, lignin, salts, chlorophylle, and a volatile oil.

Preparation and Doses.—Lobelia, 1 to 10 grains. Extractum lobeliæ fluidum, 1 to 5 minims (10 to 30 minims—emetic). Tinctura lobeliæ, 8 to 15 minims (30 to 60 minims—emetic).

Physiological Action.—Excessive doses of lobelia give rise to nausea, violent vomiting, cold sweats, pallor, marked prostration, muscular weakness, and occasionally purging. If the drug is not, in part, vomited, all these symptoms increase in intensity and the patient falls into collapse, soon followed by death. These phenomena bear out the prevailing view that paralysis of the motor nerves is the predominant influence of the drug when taken in poisonous doses. Dresser found that lobelia and its alkaloid, lobeline, stimulated the anterior section of the spinal cord. In frogs lobeline causes loss of co-ordination and disturbances of respiration. Ott observed that there occurred at first an immediate fall of arterial pressure, then a rise: a result apparently ascribable to the asphyxia induced through the influence of the drug upon the respiratory centres. Further experiments showed, however, that the rise of pressure was, in part, due to peripheral vasomotor stimulation. In therapeutics, therefore, the cardinal points to be borne in mind are that the effects of lobelia are primarily exerted upon the respiratory centres, the effects upon the vasomotor system and the circulation being secondary factors.

> Lobeline is a respiratory poison, as warm-blooded animals succumb to paralysis of respiration. In dogs it produces loss of voluntary movements and a concomitant exaggeration of the reflexes. Later, it produces paralysis of motor nerves, like curara. As it paralyzes the cardiac branch of the pneumogastric nerves, it may be included under the nicotine group. Lobeline causes an acceleration of the respiratory movements, which is more persistent when the vagi are intact. Further, it augments the power of the respiratory muscles. Small doses suppress the inhibitory influence of the pneumogastrics on the heart. While it stimulates the respiratory functions, it does not depress the system like hydrocyanic acid, and in energy it even surpasses aspidospermine. H. Dresser (Arch. f. exper. Path. u. Pharm., B. 26, H. 3, 4, '90).

At first lobeline causes an increased secretion of the sudoriferous glands, these effects lasting from five to six minutes. This increase is followed by a decrease, which, although not so pronounced as that produced by atropine, lasts for several hours. P. Aubert (Lyon Méd., Dec., '93).

Poisoning by Lobelia.—The symptoms of poisoning by lobelia or its alkaloid—lobeline—are much the same as those due to tobacco poisoning. Giddiness, faintness, trembling of the limbs, clammy sweats, frequent and prolonged vomiting accompanied by the most intense prostration, violent abdominal and œsophageal pains, with occasional purging. The pulse, at first weak, becomes almost imperceptible. The breathing becomes shallow and difficult. The vision is affected. Stupor is followed by coma or convulsions, more or less paralysis, collapse, and death by paralysis of the muscles of respiration. Vomiting is occasionally absent, and then the constitutional symptoms are accentuated, and death is apt to follow. One drachm of the powdered leaves has proved fatal in about thirty-six hours. On post-mortem examination the brain was found congested and the gastric mucous membrane inflamed.

Treatment of Poisoning by Lobelia.—The treatment of poisoning by lobelia consists in washing out the stomach by means of the stomach-siphon. Solutions of tannic or gallic acid may be given followed by the hypodermic injections of stimulants: alcohol, ether, ammonia, and strychnine. The recumbent position should be maintained, and warmth applied to the extremities. Opium given in full doses will relieve the pain, and later in moderate doses will control the vomiting.

Therapeutics.—Lobelia is chiefly used as an antispasmodic for the relief of asthma of the gastric or bronchial form. If the asthma is due to, or associated with, cardiac disease, lobelia should not be used. The drug should be taken in doses of $^1/_2$ to 1 drachm of the tincture at the beginning of the attack, or in 10-drop doses every quarter of an hour until nausea appears or relief is obtained. A feeble heart contra-indicates its use. Children are more tolerant of the drug than adults. Other spasmodic affections have been treated with lobelia,—pertussis, chorea, epilepsy, convulsions, and tetanus,—but other remedies equally efficacious and less dangerous are to be preferred.

In bronchial cough with scanty expectoration and bronchial spasm, it is sometimes useful as a depressing expectorant.

Habitual constipation due to intestinal atony and deficient secretion is often relieved by 10-minim doses of the tincture, given at bed-time. Its value is enhanced by combining it with cascara sagrada. Lobelia in infusion (1 ounce to the pint) is useful as a lotion in the treatment of the dermatitis due to poison-ivy (*Rhus toxicodendron*). Lobelia should not be employed as an emetic, as it produces too much nausea and depression. When so used it has caused death. Lobeline has been used in the treatment of spasmodic asthma. Nunes claims that it is free from nauseant or irritant properties and can be used hypodermically in doses of $^1/_6$ to $^5/_6$ grain for children and 1 to 6 grains for adults. Nunes claims a cure in eight cases of tetanus by the use of lobeline.

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LOCKJAW. See Tetanus.

LOCOMOTOR ATAXIA.

Synonyms.—Posterior spinal sclerosis; tabes dorsalis.

Definition.—An organic disease of the periphero-central sensory nervous system characterized symptomatically by incoordination, sensory and trophic disturbances; affections of special nerves, the optic and ocular particularly; and involvement of the sphincters.

Varieties. — In its classical form the symptom-complex in posterior spinal sclerosis is exceedingly constant. There are variations in the clinico-pathological picture, however, which justify a classification into at least three types: the common, or *typical*; the anomalous, or *atypical*; and the *complicated*. In typical cases the symptoms point to a primary disease of the sensory neurons of certain areas of the lower dorsal and lumbar cord (common type). Occasionally, though rarely, the primary invasion is of the upper or cervical cord (cervical or superior tabes), and in still others the initial symptom may be an optic atrophy (amaurotic tabes, initial optic-atrophy type). The predominance and persistence of pain in certain cases has served as the basis for a so-called neuralgic type (tabes dolorosa, Remak), while the early development of general or pseudoparaplegic muscular weakness, which becomes rapidly prominent, affords a basis for the recognition of the so-called paralytic type. True motor paralysis is not an essential part of tabes, however, except as a late secondary phenomenon. Occurring early, it indicates the existence of a complication. Erratic extensions of the disease into other areas of the cord give rise to anomalous symptoms, which are considered elsewhere under the head of Complications. The terms acute, severe, and mild appear in the literature of the subject, but are unimportant in significance.

Symptoms. — The symptomatic study of tabes dorsalis may be divided into at least two stages: the incipient, or preataxic, and the ataxic. The line of demarkation is so indistinct and ill defined clinically, however, as scarcely to justify separate consideration, and I shall therefore describe the clinical history as a whole, reserving for a separate analysis of individual symptoms the question of the relation of such symptoms to these two stages.

The disease, as ordinarily observed, begins very insidiously, and its early progress is usually slow. The first subjective evidence realized by the patient may be a sensation of numbness or other paræsthesiæ (tingling, burning, "pins and needles," etc.) occurring in the extremities, or, more frequently, attacks, occurring paroxysmally and without warning, of sharp stabbing pains, usually in the legs, but without constancy as regards distribution. Slight diminution or, rarely, sudden increase in sexual desire or power may be noted about the same time.

> Case of tabes in which severe lancinating pains in both legs, during a period of twenty-five years, was the only symptom of the latent tabes, while in another case the entire series of symptoms began with incontinence of urine. Hutchinson (Archives of Surg., July, '92).

> Four hundred cases of tabes collected from the private practice of Erb. One hundred of these cases were still in the initial stages. As a primary symptom lancinating pains are most frequently mentioned,—200 times in the legs, 5 times in the back, and once in the arms. Tabes begins, in the majority of instances (67 per cent.), with lancinating pains; nevertheless, these are often not present alone as a first symptom, but are accompanied by one or several others. On the other hand, these lancinating pains may exist for a number of years without the disease's manifesting itself in any other way. The frequency of the single symptoms of tabes are given as follows:—

	Percentage.
Failure of patellar reflexes	92.00
Romberg's symptom	88.75
Lancinating pains	88.25
Vesical disturbances	80.50
Ataxia of the legs	74.75
Changes in pupillary reaction	70.25
Paræsthesia of the legs	64.50
Weakness of the legs and quick fatigue	62.25
Absence of sexual desire	58.25
Changes in size of pupils	48.25
Retarded transmission of pain	36.50
Hyperalgesia of the legs	33.75
Girdle sensation	31.00
Transitory diplopia	26.50
Hyperæsthesia of the legs	23.25
Ulnar paræsthesia	16.50
Paralysis of ocular muscles	16.00
Atrophy of optic nerve	6.75
Persistence of pains in the legs	6.00
Crises	5.25
Arthropathies	1.75

Leimbach (Deut. Zeit. f. Nervenh., B. 7, Nos. 5, 6, '95).

Fatigue from exercise, as in walking, dancing, or the ordinary occupation, is greater in degree and occurs more quickly than before.

Case in which there was absence of a sense of fatigue in a tabetic patient. This patient was able to hold both arms in an horizontal position for twenty-five minutes without experiencing the slightest feeling of fatigue. Frenkel (Centralb. f. Nervenh., Psych., u. gerich. Psychop., July 1, '93).

Transient attacks of double vision may be noted with or without ptosis. The normal action of the bladder and sometimes of the rectum may be disturbed. Severe attacks of rectal neuralgia sometimes occur quite early in the disease. Examination at this time will develop the fact that the knee-jerks are either decidedly diminished in activity or even abolished (Westphal's symptom). Tests of sensation may reveal an impaired tactile perception in the distribution of the ulnar nerve (Biernacki), the peroneal (Sarbo) or the popliteal space (Bechterew), or over the plantar surfaces of the feet. The eyes, on examination, will present what is known as the Argyll-Robertson pupil, which consists in a loss of the reflex to light, although accommodation to distance is preserved. The pupils are often quite early found abnormally contracted, sometimes to a degree which has given origin to the term "pin-point" pupil. The pupils may be unequal.

The disease may remain practically stationary at this stage for some time, even for years (Gray), but sooner or later symptoms of ataxia supervene. Ordinarily the ataxia is first noticed by the patient in walking at night or along a narrow pathway or in circumventing obstructions. More effort is required. Hitherto-automatic action in walking, in standing, in dancing, and in other efforts demands more and more conscious attention in order to effect proper co-ordination. Quite early in the development of the ataxic stage the patient will present the Romberg symptom, by which is meant an inability to stand without swaying or falling if the feet are placed close together. Minor degrees of this variety of ataxia can sometimes be demonstrated only with the patient's eyes closed or by having the patient attempt to stand on one foot. In walking the ataxia is manifest in the increasing difficulty with which the patient follows, heel and toe, a chalk line or a carpet-seam or crack along the floor. Here, again, deprivation of the co-ordinating assistance of vision greatly intensifies the difficulty.

Tabetic patient in whom the disease first showed itself as arthritis tabetica in the hip-joint. Attention called to the fact that the most varied symptoms may precede the entire succession of usual

symptoms. Charcot (Nouvelle Icon. de la Salpêtrière, No. 3, '92).

[It astonishes me that, in the majority of text-books, a pronounced, and also well-known, initial symptom of tabes is not mentioned,—*i.e.*, the inability to walk backward. Obersteiner, Assoc. Ed., Annual, '93.]

One of the earliest disturbances of function in tabes is the inability to walk backward. Weiss (Wiener med. Presse, Feb. 9, '90).

The gait becomes characteristic; the feet are kept wide apart and are lifted unnecessarily high, are brought down to the floor with an appearance of unusual and unnecessary force, the heel striking first. Charcot is quoted as stating that he often made the diagnosis of locomotor ataxia from hearing the patient's footfalls as he approached the examination-room and before having seen him at all. The patient will often state, in explanation of his defective gait, that he is losing power in the legs. Attempts at forced flexion or extension, the patient resisting, will show, however, that muscular power is intact. The ataxia may extend—in the cervical cases it begins—into the upper extremities. The pianist loses his delicate technique, the machinist his dexterity. Fastening a button, especially when not in the field of vision, becomes a serious problem. If asked to touch the top of his nose with the tip of his finger or to bring his outstretched arms together so as to touch the tips of the right and left forefingers, the eyes being closed, the patient will almost invariably fail. As the disease progresses all these symptoms become intensified and others are added, chiefly sensory. The patient complains of a feeling of pressure or constriction or band of numbness around the waist or chest or throat. Various disturbances of the viscera may develop. Attacks of apparently causeless vomiting, of gastric pain, of dyspnœa, of palpitation, of vesical or rectal tenesmus occur which are known as crises. Certain trophic alterations in the skin, hair, and nails may be present or the teeth may fall out gradually and painlessly. The joints, especially the knees and elbows, sometimes enlarge suddenly, as a rule, without pain, constituting the so-called tabetic arthropathies of Charcot. The bones become easily friable. Abnormalities in the visual apparatus again become conspicuous. The transient strabismus or ptosis of the earlier stage may recur and become permanent. The optic nerve presents the symptoms of atrophy, and total blindness may result. The optic nerve may be—and, indeed, often is—affected quite early in the disease.

Case of tabes in which hemianopsia was very suddenly developed on the left side without any other symptoms. F. Peterson (Medical News, July 28, '94).

Among the cerebral nerves, those in relation with the eyes—that is to say, to its muscles—are most frequently affected in tabes. Wendell Reber (Lehigh Valley Med. Mag., June, '95).

Although choked disk may possibly occur as a part of locomotor ataxia, it is exceedingly rare, and when present is nearly always due to syphilitic lesions. Bernhardt (Berliner klin. Woch., July 15, '95).

All forms of common sensation become impaired in varying degrees and different localities. The pains lessen or disappear and an analgesia develops, which may be absolute, but is more often partial and frequently ataxic. The patient, for example, if pricked on the left leg, may refer the painful sensation to the right (allochiria) or to both legs. This phenomenon is sometimes true, also, of tactile and temperature- perception. Pain-conduction may be retarded

or delayed. Several seconds may intervene between the actual pin-prick and the patient's conscious appreciation of it.

"Sensitive tetanus" described as a peculiar disturbance of sensibility occurring in some tabetic patients; a number of pricks following each other, not too slowly, are experienced by the patient as a continuous pain, and not as separate pricks. Marie (Leçons sur les Mal. de la Moelle, '92).

Careful examination of sixty tabetic patients, with special regard to the disturbances of sensibility. In all of the cases except five, which were tabo-paralytic throughout, hyperæsthesia of the trunk was a constant and early condition. At the boundaries of the hyperæsthesia and between the lymphatic zones there is generally a pronounced hyperalgesia, particularly as regards cold. Sensory-irritation phenomena are frequent, but not constant. Marked analgesia of the ulnar nerve appears, as a rule to accompany other disturbances in the ulnar region. Max Laehr (Archiv f. Psych. u. Nervenh., B. 27, '95).

[It should be here mentioned that the ulnar symptom is also frequently met with in dementia paralytica, and is therefore not characteristic of tabes. H. Obersteiner, Assoc. Ed., Annual, '96.]

Among the disturbances of sensibility in locomotor ataxia, hyperæsthesia of the trunk appears regularly, and usually early. This consists for a long time only in an oversensitiveness to slight touches, while in opposition thereto there is usually observed in the beginning on the legs a diminution of the pain- and posture- senses. This latter appears to precede somewhat in development the trunk-hyperæsthesia, which in the beginning corresponds usually to the area of distribution of the middle thoracic nerves. Symptoms of sensory irritation are a very frequent, though not constant, accompaniment of the anæsthesia. A marked ulnar-pressure analgesia with other disturbances of sensation in the ulnar region appears to be the rule in tabes dorsalis. Lähr (Archiv f. Psych., vol. xxvii, part 3).

Literature of '96-'97-'98.

Locality of anæsthesia studied in fifty cases of tabes, ten of which had amaurosis. Four principal types found: 1. Thoracic, present in forty cases either as an horizontal zone in the nipple-region of either side, which if it reaches to the axillary line, may extend to the inner aspect of the arms; the nipple bands are united anteriorly. 2. In the upper limbs anæsthesia may be limited to the internal surfaces of the arms, or may extend along the inner aspect of the forearms to the little finger. 3. In most cases of tabes the perineal, anal, and genital regions, especially the latter, are anæsthetic, and particularly at the lower part of the scrotum; this is often found in the early stage of the disease. When present it is generally found in other parts as well, such as the thorax or feet. 4. In the lower limbs the position of the anæsthesia is very variable, being common in the plantar and dorsal regions of the foot, the dorsum of the toes, the outer surface of the legs, and on the anterior or posterior surface of the thighs. Other parts of the body where anæsthesia may be found are the epigastrium, the left hypochondrium, and the larynx. Cases of tabes with amaurosis often have normal or nearly normal tactile sensations. Subjective symptoms are related to the situation of the anæsthesia; to the first group there is often a girdle sensation, to the second numbness of the arms, to the third troubles of micturition and impotence, and to the fourth, lightning pains and "pins and needles" in the legs and feet. Marinesco (Sem. Méd., Oct. 13, '97).

Case of locomotor ataxia in a man who presented all the ordinary symptoms of locomotor ataxia: but in addition there was complete analgesia over the whole body except on and around the mouth. The analgesia began in the legs and spread upward. C. E. Beevor (Lancet, Jan. 22, '98).

The muscular sense is invariably impaired in some degree and in nearly all of its subdivisions — position, weight, pressure, etc. If the eyes are closed the patient may not be able to tell whether

a given muscle or set of muscles is being flexed or extended, pronated or supinated, by the examiner. If two wooden globes, exactly alike in appearance and size, but differing materially in weight, are placed in the hands of the patient, he cannot distinguish the heavier from the lighter. Pressing unequally with the hands upon the patient's thighs or other symmetrical parts of the body, he is unable to distinguish the inequality. The temperature sense may be also affected so that variations in the degree of contact heat or cold are not appreciated. Finally, a condition of motor helplessness or paresis may be superadded to the sensory disturbances.

Case of tabes in which peculiar vasomotor dilatations occurred, consisting of a cyanotic appearance of the face, neck, and fauces, occasional spontaneous ecchymoses and curious local sweatings. Audeoud (Revue Méd. de la Suisse Rom., Sept., '90).

Of 22 tabetic patients, 2 found in which there was paralysis of the posterior cricoarytenoid muscles; in the others no motor or sensory disturbances were found that could be due to tabes. Dreyfuss (Archiv f. Mikros. Anat., B. 20, p. 154, '90).

Case of tabetic patient in which there was total paralysis of the soft palate, also bilateral paralysis of the abductors of the vocal cords. Some of the facial muscles, the masseters and the temporals, are much wasted; the mouth hangs widely open, owing to the falling of the lower jaw. Semon (Clinical Jour., Jan. 14, '93).

Case of tabes in which there was temporarily present the rare symptom of labioglosso-laryngeal paralysis, resulting in aphonia; the impossibility of pronouncing a syllable, even softly; and movements of the tongue slow and restricted. Lépine (Lyon Méd., Feb. 18, '94).

Case of tabes with bilateral paralysis of the abductors in the larynx. Fr. Hawkins (Lancet, June 1, '95).

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Case of bilateral abductor paralysis of the larynx accompanying tabes dorsalis. There is immobility of the vocal cords, which are closely approximated, leaving only a very narrow slit for respiration. The voice is well preserved; although somewhat monotonous, it is strong and clear. E. L. Vansant (Phila. Med. Jour., Feb. 19, '98).

Several variations in the picture described, particularly as regards the order of precedence in symptoms, may occur. The disease may begin with an initial ataxia; it may begin with an optic neuritis or atrophy. In rare instances the earlier symptoms are referable to lesions in the cervical cord, the upper and not the lower extremities being affected first symptomatically. Such cases are known as cervical and sometimes as superior or descending tabes, though the two latter terms have also been applied to general paresis with secondary posterior spinal sclerosis. Painful sensory phenomena are much more marked and persistent and wide-spread in some cases than in others. The shooting, stabbing, grinding pains in the legs, the rectal pains, the trigeminal pains, the painful crises, may be all extreme and give rise when present to what has been termed the neuralgic type. If the disease develops within a year or two after primary syphilis, the symptom-picture takes on more distinctly the bizarre characteristics of exudative nervous syphilis.

Under the term "acute ataxia" are grouped cases in which the onset of the ataxia is sudden, of rapid course, sometimes quickly fatal, though often ending in recovery, being mostly cases of ataxia occurring after some acute disease, rarely arising spontaneously. The central (cerebral) form is characterized by acute ataxia, without sensory disturbances, scanning speech, resembling the speech-disturbances of multiple sclerosis. The

intelligence may or may not be affected. Recovery occurs in some cases after a few weeks; in others it becomes chronic and stationary, death occurring from some intercurrent disease. The second form—sensory ataxia—is due to multiple neuritis. It is differentiated from the ataxia tabes by its acute or subacute onset, by frequent termination in recovery, and the return of the knee-jerks. The sensory symptoms usually present are: pain, numbness, hyperæsthesia, and anæsthesia. Disturbances of speech are absent. It follows exposure to cold and moisture, acute fevers, alcoholism, lead and arsenical poisoning, and possibly syphilis. Leyden (Zeit. f. klin. Med., B. 18, H. 5, 6, '91).

Symptomatic Analysis. — *The Reflexes.*—One of the earliest—possibly the earliest demonstrable—symptom of locomotor ataxia is a diminution in activity of the patellar-tendon reflex. This diminution may be first unequal on the two sides, but, as the disease progresses, both knee-jerks are affected and eventually lost (Westphal's symptom). So constant is this symptom as to have been considered pathognomonic by some writers (Buzzard). Absence of the knee-jerks may exist in persons who are otherwise healthy, although such instances are not at all common. The integrity or abnormality of the knee-reflex may be elicited by various methods, the simplest of which is to have the patient "cross" the leg carelessly, when, with the side of the extended hand or a percussion-hammer, a sharp tap over the tense patellar tendon will ordinarily demonstrate, in the resultant jerk of the leg, the normal or exaggerated presence of the tendon-reflex, or, in the absence of response, the loss of such reflex action. Such a test, however, is crude, and should not be considered final unless practiced in conjunction with some one of the methods of sensory or mental reinforcement, the simplest of which is that known as Jendrassik's. This consists in having the patient grasp the hands tightly and look up at the ceiling, or at least away from the field of examination, as the tendon is struck. While abolition of the knee-jerk is exceedingly constant as a part of the symptom-picture, occasional examples of the disease have been noted in which the reflex was preserved and remained intact. Westphal himself, as well as Pick, Krauss, Lehman, and, more recently, Achord and Levi (La Méd. Mod., 9, p. 167, '98) have reported such instances, the explanation being found in the non-involvement, by the disease-process, of the zone of entry (*wurzell eintritt*) of the corresponding posterior roots. The occurrence of hemiplegia in a tabetic patient may result in the return of the knee-jerk, which may even be exaggerated in such cases.

The studies of Sherrington upon the phenomena connected with the patellar-tendon reflex are of especial interest in this connection.

[Mills, following the observations of Babinski (Le Prog. Méd., Oct. 29, '98) as to the significance of the tendo-Achillis jerk in tabes, examined 100 cases of nervous disease, 28 of which were tabes, with regard to this point. Of the non-tabetic cases, it is sufficient to state that he found this reflex present and equal in all of the 72 patients. Of the 28 tabetics only 3 exhibited the tendo-Achillis jerk and in all three the knee-jerk was also present. In one the phenomenon was well marked, in another slight and in the third present only on one side. Mills thinks that an investigation of the tendo-Achillis jerk may prove of diagnostic importance in removing the element of doubt present in the cases of tabes occasionally encountered in which the patellar-tendon reflex is preserved, such cases usually showing alteration of the Achilles-tendon jerk. W. B. Pritchard.]

In early tabes the cutaneous and super-

ficial reflexes are preserved and may be exaggerated: a fact of some diagnostic significance, in the opinion of Bechterew (Revue de Psych., No. 8, '97). In the late disease these also are lost.

Two early symptoms are: 1. The epigastric reflex appears more pronounced; the abdominal muscles contract when the finger-nail is passed over the skin of the abdomen; this epigastric reflex is undoubtedly, to a certain degree, antagonistic to the patellar reflex. When in tabes the abdominal reflex is more pronounced, the patellar reflex is lessened. 2. The second symptom, which is already noticeable at a very early stage, is the incapacity to raise one's self on tiptoes, the eyes being closed. Ott, Rosenbach (Centralb. f. Nervenh., etc., Apr., '92).

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Twenty-six cases of tabes investigated in which the patellar and ankle reflexes were absent in all the cases. In 11 patients in the preataxic stage, the abdominal reflexes were strongly increased on both sides in 10 and well marked in 1; of 10 cases in the ataxic stage the abdominal reflexes were much increased in 3, well marked in 5, very slow in 1, and not present in 1; of 5 cases in the paralytic stage, the abdominal reflexes were completely absent in 4 and in 1 case were increased. Ostankow (Neurol. Centralb., p. 140, '98).

The earliest, most constant, and obtrusive symptoms of locomotor ataxia in its early stage are: absent knee-jerks, shooting or lightning-like pains, and loss of iritic reflex. J. T. Eskridge (Charlotte Med. Jour., Dec., '98).

Pupillary Symptoms. — Fixed pupillary contraction (spinal myosis); a loss, abruptly, or gradually progressive, of the reflex action to light; accommodation to distance and in convergence being preserved (reflex iridoplegia, Argyll-Robertson pupil) with loss of the sympathetic skin-reflex, are the more constant and characteristic pupillary abnormalities in tabes. Both eyes are usually affected and to about the same degree. The iridoplegia may be unilateral, however; and the two pupils may be unequally contracted or one only may be abnormally small. Permanent mydriasis or dilatation has been rarely observed.

The Argyll-Robertson pupil is, perhaps, the most constant and characteristic symptom in posterior spinal sclerosis. It is also an early symptom invariably, and in combination with abolished knee-jerks affords sufficient data for diagnosis even in the absence of all other symptoms. In late tabes the action of the pupils in accommodation is also lost.

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Case of man suffering from tabes dorsalis, who, when examined in 1896, had the characteristic signs of the disease, with the exception that the pupils reacted both to light and in accommodation. Four months later the symptoms were still more pronounced, and the pupils failed to react either to light or in accommodation. This condition continued for nearly a year, when it was found that the pupils reacted well to light and continued so to react for the remainder of the period during which the patient was under observation. The case illustrates improvement in the pupillary symptoms, while the general symptoms grew worse. Trenpel (Münchener med. Woch., Aug. 30, '98).

Two cases of intermittent Argyll-Robertson pupil in tabes dorsalis. Both patients were women 38 years of age. In both cases there were evidences of syphilis, and the symptoms of tabes were plain. The pupil reflexes varied under continued observation and notwithstanding steady progress of the disease. Eichhorst (Deut. med. Woch., No. 23, '98).

The lesion in Argyll-Robertson pupil is probably in the fibres which pass from the proximal end of the optic nerve to the oculomotor nerve, according to de Schweinitz, who quotes Turner, however, as believing that a single lesion in

the forepart of the oculomotor nuclei in the Sylvian gray as the cause of both myosis and reflex iridoplegia.

Optic Atrophy. — This symptom may occur at any stage, though usually it is present in early tabes. It has been found in from 10 to 35 per cent. of cases according to the observer. Bergur found it present in 44 of 109 cases. Disturbances of color-sense and contraction of the visual field are associated phenomena. The progress of the atrophy is usually slow, and remissions may occur. Blindness ensues in from three to five years. The ataxia and also the painful sensory symptoms diminish upon the onset of blindness, as a rule (amaurotic tabes). The left eye is said to be attacked oftener than the right. Both eyes are usually involved, however.

Five cases of tabes in which atrophy of the optic nerve preceded the usual symptoms of tabes during a long period (up to twenty-five years). Howell Pershing (Med. News, Mar. 26, '92).

The onset of optic neuritis in the early stage of tabes is followed by improvement in other symptoms, and retards or arrests the further course of the disease. Martin (Neurol. Centralb., Oct. 1, '90).

The specific motor symptoms in tabes begin to disappear as soon as atrophy of the optic nerve sets in. Benedikt (La Méd. Mod., Mar. 20, '95).

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In about 75 per cent. of the cases of tabes, in which optic atrophy is an early symptom, some of the other tabetic symptoms may be late in appearing or may not develop at all. This is especially the case in respect to the lightning pains and the inco-ordination of movement. The loss of knee-jerk in such cases is very constant.

The most distressing symptoms may develop simultaneously with or immediately succeed the blindness.

The association with the optic atrophy of oculomotor palsies is without prognostic significance. Pearce Bailey (Med. Rec., Nov. 14, '96).

Ophthalmoscopically the optic atrophy of posterior spinal sclerosis presents the appearance of primary degenerative atrophy in contrast to the appearance in that form which follows neuritis.

Ocular-Muscle Palsies. — One of the first symptoms in locomotor ataxia may be an attack of double vision with or without ptosis. Occurring in the early stages of the disease, such attacks are usually of abrupt onset and transitory duration, disappearing completely in a few days or weeks. Well-marked strabismus, most commonly of the variety due to sixth-nerve involvement, may be present, and, if an early symptom, is equally abrupt in onset and transient in duration. Möbius believes that sudden painless ocular palsies in an adult are almost pathognomonic of tabes. They are certainly exceedingly suggestive. Ptosis, more or less decided, is frequently noted in late stages of posterior spinal sclerosis. Such ptosis is usually of slow progressive development and remains permanent. This is true, also, of strabismus. Ophthalmoplegia, both external and internal, has been sometimes observed, though with decided infrequency.

Interesting case of tabes with cranial-nerve palsies (third, fourth, fifth, and sixth), supposed to be of nuclear origin, and with muscular atrophies in the upper and lower extremities. The case had been reported at an earlier stage by Seguin as one of external and internal ophthalmoplegia, with incipient tabes. Peterson (Jour. of Nerv. and Mental Dis., July, '90).

Case of chronic progressive paralysis of the ocular muscles in a patient suffering with tabes and general paralysis of the insane. Boedeker (Centralb. f. Nervenh., etc., June, '91).

Patient in whom the symptom of paralysis of the eye-muscles occurred in the

first stage of tabes; all the external muscles innervated by the nervi oculomotorius became paralyzed later on. Rendu (Le Bull. Méd., Mar. 16, '92).

Transient ptosis, or diplegia, Argyll-Robertson pupil, incipient optic-nerve atrophy, associated in an individual past middle life, of inherited neurotic tendency, are strong presumptive evidence of the first stage of locomotor ataxia. Hansell (Jour. Nerv. and Mental Dis., Apr., '93).

Slight paresis of the ocular muscles, particularly in the early stages of tabes, even though of temporary duration, is of very frequent occurrence, though often overlooked. G. Rummo (Lezioni di Clin. Med., 894).

Ataxia. — The disease may manifest itself first in an ataxia of gait or station (acute locomotor ataxia). Usually, however, as has been already stated, various sensory and other symptoms prominently precede the ataxia, disturbances of co-ordination being essentially dependent upon impaired centripetal or sensory impressions. Loss or defect of muscular sensibility and particularly of position-sense is the dominant factor responsible for the ataxic gait and the inco-ordination of the upper extremities. The phenomenon known as Romberg's symptom is probably due to the associated involvement of both tactile and muscular sensibility. Leyden's experimental induction of this symptom by freezing (anæsthetizing) the soles of the feet with ether-spray demonstrates at least some participation of the tactile sense in the production of this symptom. Helplessness from ataxia should be, it is scarcely necessary to state, carefully distinguished from helplessness due to true motor paralysis or paresis.

Romberg's symptom is caused solely by a feeling of dizziness when the eyes are closed. Grasset (Archives de Neurol., vol. xxv, '93).

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Case of locomotor ataxia in which, notwithstanding the fact that the patient was perfectly blind, he could stand with his feet close together with but little swaying. The moment he closed his eyes, however, he swayed violently, and would fall over if not supported. F. F. Ward (Med. Rec., Oct. 8, '98).

Tabetic Crises.—These consist of attacks, occurring suddenly, without assignable cause and ending quite abruptly, as a rule, which may simulate symptomatically ordinary attacks of gastric, intestinal, nephritic, vesical, or hepatic colic. Gastric crises are most common. The patient is suddenly seized with excruciating gastric or abdominal pain, which is usually accompanied with violent retching and vomiting. The attack may be prolonged for two or three days or it may end after a single paroxysm lasting a few minutes, recurring at varying intervals from a week to several months. Except from malnutrition, such attacks are not dangerous.

Case of tabetic patient in whom, simultaneously with the gastric crises, pronounced acuteness of the sense of smell is present. Negro (Rev. Clin. de los Hosp., Mar. 8, '94).

Case of man in the paralytic and atrophic stage of tabes, whose gastro-intestinal crises were accompanied or ushered in by profuse sialorrhœa, beginning suddenly, often at night, and nearly choking the patient. Gastric crises would follow, then intestinal crises, sometimes accompanied by genito-urinary symptoms, the attacks lasting from three to twelve days. Girode (La France Méd., Feb. 19, '89).

Three cases of tabes in which gastric crises were the first symptom, and, later on, remained the dominant one. There was a constant lack of hydrochloric acid both during the crises and in the intervals. L. Wolff (Lakäre. Forhänd., '95).

[It is striking that gastric crises are very frequently combined with laryngeal

symptoms and are seldom absent when arthropathies are present. H. Oberstein, Assoc. Ed., Annual, '96.]

When, however, the heart's action or the functions of respiration are involved, the danger is much greater, fatal results having been recorded in both cardiac and laryngeal crises. Both varieties, fortunately, are rare. The symptoms in laryngeal crises are not unlike those of laryngismus stridulus: dry, violent cough, with spasmodic inspiration and marked dyspnœa and at times loss of consciousness. Burning pains in the neck and shoulder-muscles sometimes attend these laryngeal crises.

Two cases of tabes: one with laryngeal crisis, the other with hyperæsthesia to light and sound. Charcot (La Sem. Méd., June 4, '90).

Case of tabes with laryngeal crisis, in which the post-mortem histological examination revealed, besides the usual characteristic spinal lesion of tabes, a bilateral chronic diffuse neuritis of the vagus and spinal accessory roots, but without involvement of the nuclei of these nerves. Van Gieson (Jour. of Nerv. and Mental Dis., July, '90).

In 122 cases of tabes laryngeal disturbances referable to tabes were found in 17 cases. In 4 cases laryngeal crises were observed. Bohne (Inaug. Dissert., '95).

Case with pharyngeal crises. Patient was a man who had become exceedingly emaciated, the slightest attempt at taking nourishment causing severe contractions of the pharynx. After a single treatment by suspension, this condition entirely disappeared. Cornmont (Revue de Méd., Sept., '94).

Two cases of severe pharyngeal crises, one of the patients dying during such an attack. Moreira (Pharingismo Tabetico, '94).

Attention called to peculiar pains in certain glands which may occur in tabes from time to time. Several hours before the onset of the attack the patient complains of a peculiar, uncomfortable sensation in the region in question, and suddenly very severe pain is felt, lasting several hours; the glands quickly swell, and the skin becomes reddened; the swelling and redness slowly disappear after a few days. Wood (La Sem. Méd., No. 7, '93).

Cardiac Crises.— Cardiac crises resemble symptomatically attacks of angina pectoris. There may be actual disease of the heart of trophic origin. A rapid pulse—100 to 120—was frequently noted in Charcot's cases without associated cardiac crises.

Case of tabetic patient who was subject to attacks of tachycardia with accelerated breathing without dyspnœa; these attacks occurred several times a day and lasted about half an hour. They were cardiac crises. Zenner (Ohio Med. Jour., Dec., '91).

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In 138 cases of locomotor ataxia 12—or 8.76 per cent.—were complicated with valvular disease. In 9 of the cases—or 6.5 per cent.—the lesion was aortic disease. The valvular affection generally first showed itself after the tabetic symptoms were well advanced. Five cases were undoubtedly syphilitic, and 6 probably so, but in 1 case there was no evidence of the disease. In 2 cases aortic aneurism was associated with the valvulitis. Rheumatism was only noted in 2 of the 12 cases. As symptoms are not always present, the aortic disease may be overlooked. The association of the two diseases is probably the result of syphilis, which is an important cause, both of tabes and of cardiac disease. Ruge and Hutter (Berliner klin. Woch., Aug. 30, '97).

The crises of tabes possess a localizing pathological value quite analogous to that of the aura or signal symptom in epilepsy, pointing to an invasion and irritative degeneration of the vagus-nuclei or fibres, or to fibres elsewhere that are in physiological relation to the functions involved in the symptoms. Crises are among the earlier clinical phenomena usually, but they may persist for many

years. They often disappear with the lancinating pains, with which they are intimately associated, as the disease advances.

A constant secretion of tears is sometimes met with in tabes, while in other cases there are actual tear-crises, similar to gastric crises. Panas (La Presse Méd., May 4, '94).

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Case of a waiter, 41 years old, who suffers from locomotor ataxia and beginning paralytic dementia. He has frequent and sudden attacks of violent burning pain in both eyes and the peribulbar tissues, accompanied by spastic myosis, epiphora, and chemotic swelling of the conjunctivæ. There also is much hyperæsthesia in the eyelids, which makes further examination of the eyes impossible. These attacks last from two to three hours; an hour after the attack the eyes are practically normal. These attacks considered to be true ocular crises—attacks of neuralgia of the ciliary nerves, and irritation of the fifth nerve. Pel (Berliner klin. Woch., No. 2, Jan. 10, '98).

Sensory Symptoms. — The defects or abolition in the several forms of common sensations have been sufficiently described in the clinical history of which they form an exceedingly constant and essential part. Among the less frequently noted sensory phenomena are analgesia of the testicle and anæsthesia in the distribution of the fifth nerve, especially over the mucous membranes of the mouth and eyelids.

Frequent changes in the pharynx and larynx of 36 tabetic patients. There were sensory disorders of the pharynx in 14, of the larynx in 10, paresis of the adductors in 10, immobility of the cords in 4, diminished power of adduction in 8, and ataxic movements of the tongue in 9. The pharyngo-laryngeal disorders were more intense in the advanced stages of tabes. Marini (Archiv f. Psych. u. Nervenk., B. 21, H. 1, '90).

Case presenting the typical signs of tabes of many years' duration, in which lancinating pains occurred in the left side of the face, and in which the pharynx was insensible to the touch, and the uvula anæsthetic and paretic. Speech and deglutition, however, were not affected. Schnell (Marseille-méd., Oct. 15, '91).

Case of male tabetic patient, with ulcerations both in the region of the right upper and the left lower jaw. These ulcerations are to be referred to a tabetic neuritis of the trigeminus, since complete anæsthesia of the face and mucous membrane of the mouth was present. Hudelo (Bull. de la Soc. Française de Derm. et de Syphil., May 18, '93).

Pitres found analgesia of the testicle in 75 per cent. of his cases. It varies in degree from time to time and may disappear entirely to return, however, after varying intervals. Its disappearance has been noted as occurring simultaneously with a return of sexual power. While pain is a very common symptom in many forms of nervous disease, the sharp stabbing vagabond pains which occur in locomotor ataxia are so distinctive in character as to be unique. No two patients will, perhaps, describe them in the same way, and yet their identical character is at once evident from the description of a dozen or more patients. They are often worse at night and under barometric conditions of excessive humidity presaging a storm. Tabetics are often, indeed, quite reliable weather-prophets.

Of 34 tabetics, 8 had normal testicles, 10 were hyperalgesic, and 16 analgesic; of the latter 4 had atrophy of the testicle. Pitres's sign considered of great value. It consists in the loss or diminution of the characteristic pain produced in the normal testicle by compression. Bitot and Sabrazès (Jour. de Méd. de Bordeaux, Feb. 2, '90).

Among 35 tabetic patients, both testicles were normal in 11, in 4 there was bilateral analgesia; in 4 bilateral hyper-

aesthesia; in 2 there was atrophy of both testicles; in 2 atrophy of only the right testicle; in 7 diminished sensibility of the penis; and in 11 impotence. Analgesia of the testicles and failure of the cremaster reflex are entirely independent of each other. In 15 patients incontinence was found, in 3 retention, and in 1 ischuria paradoxa (constant dropping of urine from a full bladder). B. A. Tatartscheff (Die Urogenital Storungen bei Tabes Dorsalis, '92).

Trophic Symptoms.—Some degree or variety of trophic disturbance is usually manifest at some time during the progress of the disease. Such trophic disturbances do not appear as complications, but are essentially a part of the disease. Occurring in the early stages, they are due to involvement of the peripheral trophosensory fibres; late trophic symptoms may be dependent upon lesions of the ventral horns. Among the trophic symptoms are superficial and perforating ulcerations of the skin and other cutaneous lesions, loss of the hair or teeth, onychia; atrophies of muscles, singly or in groups; nutritional disease of the bones, particularly the femur, giving rise to spontaneous fractures; affections of the joints known as arthropathies, with secondary luxations and displacements; œdema, and bed-sores.

Case of man in whom there were transverse fractures of both the upper thighbones without any apparent cause, the second fracture occurring after an interval of four months. The retarded consolidation, with the enormous callous formation, go toward proving a medullary cause for these spontaneous fractures. Fourmeaux (Jour. des Sci. Méd. de Lille, June 16, '93).

Multiple lipomata witnessed in personal case: These may be regarded as a peculiar trophic manifestation in tabes. The patient suffered from lancinating pains and paræsthesia in the lower extremities. After two years these symptoms disappeared and instead small lipomata appeared simultaneously on both forearms, at first growing larger and then remaining stationary. Similar lipomata then appeared on the hips and thighs. The unmistakable symptoms of tabes only presented themselves later on. Tscherkassoff (La Méd. Mod., Mar. 25, '95).

Tabetic patient in whom a great many cerebral nerves were diseased, even the seldom-affected facial nerve. Asymmetry of breathing was particularly noticeable, the left half of the thorax being much less active than the right. Chvostek (Neurol. Centralb., Nov. 15, '93).

Perforating ulcers almost invariably develop on the plantar surfaces of the feet, often beneath the great toe, and may be symmetrical. Such ulcers may occur quite early in the disease. I recall the case of a patient in whom such ulcers led to the discovery that he was suffering from locomotor ataxia, the discovery overwhelming him with surprise.

Herpes is not an uncommon accompaniment of the severe neuralgic or neuritic pains sometimes observed. Baldness or anomalies in pigmentation, especially the former, are common. The teeth may all fall out as a result of involvement of the fifth nerve.

Atrophy of the jaws, with loss of the teeth, frequently occurs in tabetic patients. Rosin (Deut. Zeit. f. Nervenh., vol. i, '92).

Case of tabes with bilateral atrophy in the region of the trigeminus, loss of the teeth, paralysis of the soft palate, laryngeal crises. There was found degeneration of the ascending (spinal) root of the trigeminus, of the ascending glossopharyngeus root (fasciculus solitarius), and of the substantia ferruginea. Pacetti (Trans. Eleventh Inter. Med. Congress, '94).

Case of tabes with perforating ulcer of the mouth and loss of the teeth. No other bulbar symptoms were present. Letulle (Revue Neurol., Oct. 15, '94).

Spontaneous loss of the teeth most frequently occurs in the later stages of the

disease, and is due to the diseased condition of the nervus trigeminus. Lemaire and Bernard (L'Odontologie, Feb., '94).

Onychia is sometimes very troublesome, and wounds or operations upon the extremities, especially the feet, may prove quite obstinate in healing. Muscular atrophy, if extensive and affecting groups or an entire limb, is a late incident in the disease. Extensive atrophy occurring early indicates a probable complication. Atrophy of single muscles may occur, though not frequently early, as a result of the neuritis.

From 10 to 12 per cent. of all tabetic patients are affected with muscular atrophy. This tabetic muscular atrophy is principally characterized by the great slowness of its development; fibrillary contractions and degeneration reactions are not present. Déjerine (Ann. de Méd. Thermale, '92).

Case of tabes in a female patient in which there was also increasing paralysis and atrophy of the lower extremities. These symptoms were due to atrophy of the peripheral nerves of the lower extremities, as was proved by the post-mortem. Goldscheider (Zeit. für klin. Med., vol. xix, '92).

Case of tabes in which there existed a general muscular atrophy and also marked involuntary movements of the lower extremities and of the face during sleep. Lacaze (Montpellier Méd., No. I, '93).

Case in which the symptoms of progressive muscular atrophy first presented themselves, those of tabes only occurring several years later. J. Collins (Jour. of Nerv. and Mental Dis., Feb., '94).

The arthropathies and osteopathies, which are ordinarily associated phenomena, have been especially studied by Charcot, Déjerine, and others. They occur in from 5 to 10 per cent. of cases. The knees are chiefly affected. The smaller joints usually escape, though Hirtz (La Méd. Mod., 9, p. 48, '98) has recently reported a case with radiographic illustrations, involving the metatarso-phalangeal articulations. In some cases there exists, without swelling or deformity, a remarkable relaxation of the muscles of the knee and other joints, permitting extreme degrees of hyperflexion and hyperextension. This condition has been called "hypotonia" by Frenkel, who considers it an early symptom.

Three cases of ataxic arthropathy in one of which the disease of the joint was one of the first symptoms of tabes. Krögius (Finska Lakäre-sall. Händ., vol. xxxv, '93).

Case of pronounced gonitis tabetica. As the diseased leg was a great hindrance in walking, it was amputated at the thigh. R. Rasmus (Inaug. Dissert., '94).

Attacks of œdema in the extremities or elsewhere, usually transient and of a type similar to angioneurotic œdema, have been noted. Bed-sores on the sacrum, over the trochanters, or at other points exposed to prolonged pressure are ordinarily late symptoms and belong to the bed-ridden stage. In this connection, an emphatic protest might be introduced against the custom, sometimes practiced for the relief of pain in the legs, of tightly binding a cord or ligature around the limb. It may, and sometimes does, effectually relieve the pains, but at great risk of inducing far more serious trophic disturbances.

Vesical, Rectal, and Sexual Symptoms.—Slight incontinence or slowness in micturition may first attract attention to the possibility of tabes. This may vary from time to time, and is rarely extreme or particularly annoying. In the late stage of the disease there may be partial or total anæsthesia of the bladder, with either absolute incontinence or the opposite condition of retention. The urine may be retained without discomfort for many hours, and, unless withdrawn by

catheter, a cystitis may develop. Catheterization should be practiced very carefully in such patients.

In patients suffering from tabes dorsalis the bladder can be voided by compression, only, however, when the patellar reflex has subsided. If in such cases of paralysis of the bladder, occurring in diseases of the spinal cord, pressure is exerted upon the abdomen in the region of the bladder, it is often possible to cause the urine to flow without its being necessary to use the catheter. J. Wagner (Wiener klin. Woch., Nov. 24, '92).

Tabetics are almost invariably constipated, although in the advanced disease incontinence of fæces may be present. The rectal region may be the site of sharp, stabbing pains in neuralgic cases. Sexual desire and power, while invariably impaired or abolished in the advanced disease, is sometimes, in the beginning of tabes, quite distinctly exaggerated, the patient being led into the grossest excesses in sexual intercourse. Such paroxysmal satyriasis may give way to total temporary abolition of sexual function, the paroxysms recurring at varying intervals.

Special Senses.—In addition to vision, hearing, taste, and smell are each or all of them sometimes impaired. Hearing is affected in about 25 per cent. of all cases. Deafness is sometimes, though rarely, due to atrophy of the auditory nerve, sometimes to a trophosclerotic condition of the middle ear through involvement of the fifth nerve.

Of 53 cases of tabes, 43 had some disorder of the auditory functions. Morpurgo (L'Union Méd., July 3, '90).

In 20 cases of tabes auditory disturbances found in only 5; of these, 10 per cent. had nervous deafness. Tabes not infrequently causes trophic changes in the middle ear (a sclerotic process), which may lead to disturbances of hearing. Treitel (Arch. of Otol., Oct., '90).

Series of 40 cases of tabes, 7 of which had normal hearing; 29 had some affection of the auditory apparatus, of which 4 had middle-ear disease, and 15 had positive internal-ear disease, which was also suspected in the remaining cases. Ménière's symptoms were not found in any case. Marini (Archiv f. Psych. u. Nervenk., B. 21, H. 1, '90).

Tabetic lesions of the auditory nerve are usually only present in the preataxic stage, notably in cases of so-called tabes descendens. Cozzolino (Revista Clinica e Terap., Feb., '94).

Only four cases of tabes have been met with up to the present in which atrophy of the acoustic nerve was discovered at autopsy. In the great majority of cases there is a sclerotic affection of the middle ear, which may be considered as a trophic disturbance following a diseased condition of the trigeminus nerve. Usually there is a more or less pronounced deafness, which is generally very quickly developed, often in a few months. In more than half of the cases a subjective noise precedes the deafness, the sound being of varied nature (musical, whistling, buzzing, etc.) and also of varying intensity, sometimes excessively loud. Collet (La Presse Méd., Jan. 12, '95).

Taste and smell are believed to be rarely affected, though Klippel (Archiv de Neur., 3, p. 257, '97) does not agree with this statement, believing that these two senses are much more frequently involved than is indicated in the literature. They are, moreover, among the earliest symptoms in tabes, according to this author, who describes the findings in a case of tabes presenting these symptoms, which came to autopsy, consisting of marked degenerative disease of the olfactory, glosso-pharyngeal, and trigeminus nerves and their ganglia.

Diagnosis.—The chief and most important problem in diagnosis is with regard to the prompt recognition of the incipient or preataxic stage. No single symptom is pathognomonic, although the Argyll-Robertson pupil is considered

by Möbius and others as invariably indicative of either locomotor ataxia or general paresis. The conjoint association of any two of the four most constant symptoms—abolished knee-jerks, Argyll-Robertson pupil, lightning pains, and ocular palsies—is quite suggestive, if not diagnostic in importance. The simultaneous existence of these four symptoms occurs in no other disease, and is positively diagnostic. The subsequent development of ataxia completes a clinical picture which is unique and is not even simulated by any other disease.

It is always well to think of tabes in diagnosticating abdominal affections accompanied by repeated attacks of pain, even in the absence of other sensory affections, motor or oculo-pupillary phenomena, or the preservation of the knee-jerks. Laget (La Semaine Méd., Sept. 23, '91).

The patellar reflex is never absent in healthy persons, but only when there is structural disease of the musculo-nervous system. Gowers (Clin. Jour., Oct. 4, '93).

The symptom described by Pitres as haphalgesia (sensation of pain upon delicate touching with certain substances) is not a pathognomonic symptom of hysteria, but may also occur in tabetic patients. Lannois (La Sem. Méd., Aug. 31, '92).

Symptoms of tabes dorsalis may be partially simulated by a peripheral neuritis, even without a diseased condition of the spinal cord. In cases in which peripheral neuritis is rapidly developed the following symptoms furnish the differential diagnosis of pseudotabes: very rapid progress of the disease; pain in the muscles proper and in the nerve-trunks; undisturbed pupillary reaction. Déjerine (La Sem. Méd., No. 26, '93).

Marked hyperflexion of the leg at the hip-joint, without bending it at the knee, is painful in healthy subjects, while in tabetics, even during the first stages of the disease, it causes no pain. Putnam (Boston Med. and Surg. Jour., Aug., '95).

The paræsthesia in the region of the trigeminus designated as "Hutchinson's mask," with a feeling as of a spider-web over the skin of the face, may be met with in the early stages of tabes, and is of diagnostic value. Möbius (Neurol. Beit., No. 3, '95).

Twenty tabetics in which it was found that on presure upon the ulnaris, in the sulcus ulnaris at the elbow, there was no sensation of pain fourteen times on both sides and once on one side. Considered a pathognomonic symptom of tabes. Biernacki (Gaz. Lekar., No. 2, '94).

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In many early cases of tabes there is insensibility to pain on pressure and on tapping of the popliteal nerve, this symptom is more commonly present than Biernacki's sign of anæsthesia of the ulnar nerve. Bechterew (Neurol. Centralb., p. 140, '98).

There is no pathognomonic symptom of tabes, but two symptoms are considered of value in making an early diagnosis. The first is the remarkable increase of the abdominal-wall reflex. Abdominal or other cutaneous and tendon-reflexes are antagonistic phenomena, and this antagonism may serve, in doubtful cases, as a means of diagnosis. Patients during the first period of locomotor ataxia with loss of the patellar reflex have an unusually-marked abdominal reflex, while the lack of the latter, along with increased patellar reflex, is indicative of a cerebral lesion, which causes no irritation in the neighborhood of the affected spot. The second sign is the behavior of the patient when asked to rise on his toes, with his eyes closed, and to remain standing. Those in the first period of tabes, with only the slightest symptoms of musculo-tonic troubles, and without any sensible alteration, are not able to execute this act. O. Rosenbach (Brit. Med. Jour., Oct. 1, '98).

Among the diseases to be considered and which at times obscure the diagnosis, are ataxic paraplegia, disseminated sclerosis, brain-tumors, certain forms of myelitis; the syphilitic meningomyelitis of Oppenheim, Sachs, and others; multiple neuritis, and post-diphtheritic paralysis.

In the ataxic paraplegia of Gowers there is actual loss of motor function with spasticity, the knee-jerks being usually exaggerated with little if any pain, no crises, no arthropathies, and no involvement of the muscles of the eye.

Two cases of ataxic paraplegia. In both cases the ataxia was very marked, but yet seemed to differ materially from tabetic ataxia. Cocking (Brit. Med. Jour., Jan. 14, '93).

In multiple sclerosis there may be ocular palsies, pains (slight) in the lower extremities, defects of sensation, sphincteric involvement, ataxia, and even abolished knee-jerks. The knee-jerks are usually exaggerated, however; the pains differ in degree and character, and in disseminated sclerosis the peculiar speech, intention-tremor, nystagmus, and special variety of optic atrophy (Gnauck) are distinctive.

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Locomotor ataxia resembles disseminated sclerosis (1) in often showing in its early stages sparse, scattered, sclerotic lesions; (2) in possessing other anatomico-clinical syndromes, which correspond to other scattered centres of sclerosis of the nervous system; (3) in being frequently associated in the same subject with various scleroses of other organs besides the nervous system. The etiology of both diseases is very complex. Syphilis is the most frequent cause, but it is not the only etiological factor, even in cases in which it is found. Arthritis, different intoxications, the neuropathic disposition, and several other causes may all co-operate to produce the disease and determine its localization in the cord. Grasset (Gaz. Méd. de Liège, Aug. 26, '97)

Ataxia is common in tumor of the cerebellum, the frontal lobes, and the base of the brain. Optic atrophy and ocular palsies are also frequently encountered. Attacks of cerebral vomiting may simulate the gastric crises of tabes. The clinical picture and history of focal palsies, headache, hebetude, etc., in brain-tumors serve to distinguish the two conditions quite readily. In myelitis the absence of optic atrophy, ocular palsies, and Argyll-Robertson pupil are sufficient to eliminate any element of temporary confusion. In multiple neuritis the deep reflexes are abolished or diminished, there may be much pain, and the ataxia may be decided. The rapid atrophy and true motor weakness, with altered electrical reactions, together with absence of pupillary changes, and preserved light-reflex establish the diagnosis readily. Post-diphtheritic paralysis, when it simulates, through the ataxia and sensory symptoms present, true tabes dorsalis, is a multiple neuritis, and the differential data are the same. In syphilitic meningomyelitis there is, at times, a close clinical resemblance to true locomotor ataxia. In such cases, however, motor as well as sensory defect is present, the symptoms are unilateral or at least unequal in degree on the two sides, the Argyll-Robertson pupil is not present, and prompt improvement nearly always follows the energetic use of potassium iodide and mercury.

Should the disease begin in the cervical cord, it is at times difficult to differentiate locomotor ataxia from syringomyelia: a fact which has been especially emphasized by Marie. Cervical tabes is a rare form of the disease, Déjerine finding only one such primarily in one hundred and one cases at the Bicêtre.

Case of a tabetic patient having symmetrical gangrene of the toes, and who also showed the well-known dissociation of sensibility; therefore syringomyelia might also have been suspected: there was, however, no muscular atrophy. Post-mortem showed, besides the sclerosis of the posterior columns, an acute neu-

ritis of both nervi peronei. Kornfeld (Wiener med. Woch., Nov. 5, '92).

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[Psychical disturbances during the course of tabes are rather rare, but not quite so rare as is usually believed. It is necessary, in such cases, to carefully guard against confounding these disturbances with a condition of dementia paralytica combined with ataxic symptoms. H. Obersteiner, Assoc. Ed., Annual, '96.]

All cases of gradually-progressive blindness—if dependent upon optic atrophy and especially if occurring in negroes—should excite suspicion and lead to careful examination for the presence of other symptoms of locomotor ataxia.

Etiology.—Heredity is of very minor importance, if, indeed, it is a factor at all in the etiology of the disease.

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Mother and son, aged 51 and 27 years, respectively, both suffering from typical locomotor ataxia. There was nothing whatever to suggest syphilis either in the history or in the patients. In the mother the disease began at 31 years; in the son at 26 years of age. Other cases have been recorded in which the children of parents who had locomotor ataxia showed symptoms of the disease much earlier than in this case, but in children the diagnosis must be made with caution, as Friedreich's disease is easily mistaken for locomotor ataxia. Kalischer (Neurol. Centralb., Dec., '97).

The same is true of diathetic states, although a rheumatic predisposition may possibly favor its development. Next to syphilis, the occupation and previous habit of the individual as regards excesses, particularly physical, are most important. Railroad-employees, especially engineers, soldiers, sailors, policemen, lumbermen, drivers, and others whose work combines exposure to wet and cold, with severe physical exertion, are quite numerous among the victims of tabes. Excesses in athletic sports, in dancing, and in sexual intercourse are all considered adequate predisposing or even exciting causes when combined with syphilis.

Two cases of tabes in females who had worked excessively at sewing-machines. Guelliot (L'Union Méd., Nos. 2 to 4, '82).

Case of tabes in a woman, aged 28, without a history of syphilis or hereditary defects, who worked a double-pedal sewing-machine from morning until midnight for several years before her symptoms appeared. Bernhardt (Neurol. Centralb., Dec., '90).

Traumatism to the spine in the nature of direct violence or concussion, as from a violent fall on the feet, has been, in some instances, the only apparent cause.

Tabes traumatica is of very rare occurrence and has no characteristic symptoms. Should, however, a trauma, either alone or in combination with exposure to cold, be, under certain circumstances, the promoting cause of tabes, we should be forced to assume that, in these cases, the trauma or the cold had proved the agent inducing the formation of a poison corresponding, in its operation upon the nervous system, with the hypothetic poison of syphilitic infection. Hitzig (Fest. zur 200 Jährigen Jübelfeier, in Halle, '94).

The current view that locomotor ataxia may be caused by traumatism *per se*, irrespective of a direct lesion of the cord, is not sustained by the published evidence thus far adduced. It would seem, aside from mere coincidence, that, when a sclerosis of the posterior columns develops after a traumatism, the subject was already doomed to this condition, the process having already begun, and that the traumatism at most only accelerated the development of the symptoms and possibly of the anatomical process. Morton Prince (Jour. of Nerv. and Mental Dis., Feb., '95).

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Case in which, five weeks after traumatic rupture of the thigh-muscles, pains came on in the legs; in seven months the gait was uncertain, and in a year the man was suffering from typical tabes. The patient had not suffered from any symptoms of tabes before the accident. Syphilis as well as other possible causes of tabes were excluded. In this case an ascending neuritis was probably followed by the tabes. Lammers (Centralb. f. inner. Med., July 31, '97).

Of all the etiological factors, syphilis appears most constantly and is unquestionably of the greatest importance. Many neurologists, indeed,—among them Möbius, Tarnowski, and others,—believe that the development of locomotor ataxia implies necessarily the pre-existence of syphilis. This is, beyond question, an exaggerated estimate of the facts, but it is also true that a history or collateral evidence of syphilis can be elicited or demonstrated in more than 50 per cent. of all cases. Erb found 89 per cent. in 300 private cases. The exact pathogenetic relationship is not clear. Syphilis is more than an indirect or simple predisposing factor, and yet the length of time usually elapsing between the period of syphilitic infection and the symptomatic beginning of locomotor ataxia would indicate that its action must be quite indirect. The interval sometimes amounts to thirty years or more. On the other hand, I have seen well-marked locomotor ataxia present in a patient who was at the time under energetic treatment for cutaneous syphilis, infection by senile chancre having occurred less than 18 months previously. Three years later the disease was still present, though not advancing. In 34 cases personally observed by me the average interval between the period of syphilitic infection and the first-recognized symptoms of locomotor ataxia was $9\,^1/_2$ years.

Case of patient who, in 1878, developed pronounced signs of tabes; in 1883 he contracted syphilis, from which time the tabetic symptoms rapidly developed. The case proves that syphilis is not necessarily the cause of tabes. Leloir (Jour. de Méd. de Paris, Dec. 1, '89).

Syphilis may provoke nutritive disturbances of the system, which render a person more liable to tabes than one who has not had specific disease; but tabes is not a symptom of syphilis, being an independent disease, upon which syphilis has only an indirect effect. Vermel (Le Prog. Méd., Feb. 22, '90).

Tabes is a "disease of exhaustion" of the spinal cord, referable to a disturbance of the nutrition of the cord, induced by some noxious agent (notably syphilis). Edinger (Volkmann's Samml. klin. Vort., No. 106, '94).

Syphilis is the only important etiological factor in tabes, being the true and almost the sole cause, all other influences being of comparatively little importance. Besides syphilis the nervous condition of *hérédité nerveuse* may alone be considered as an important primary cause. Marie (Leçons sur les Mal. de la Moelle, '92).

Case of early tabes syphilitica in which the first symptoms of tabes showed themselves four months after the chancre, in the form of laryngeal crises, and in the space of five and a half months tabes was fully developed: the course of the disease, notwithstanding continuous antisyphilitic treatment, was very rapid. Pauly (Lyon Méd., June 12, '92).

The relationship of syphilis to tabes is demonstrated by the frequent occurrence of paresis with tabes, and of tabes in the course of general paresis. The occurrence of symptoms in the course of tabes which are often due to syphilis,—ocular palsies, loss of pupillary reflexes, and even lightning pains. The effect of mercurial and iodide treatment upon many of the symptoms of tabes. Sachs (N. Y. Med. Jour., Aug. 12, '93).

[The first symptoms of tabes only occur several years after syphilitic infection, most frequently from the sixth to

the tenth year; only very rarely does tabes show itself in the florid stage of syphilis. H. Obersteiner, Assoc. Ed., Annual, '93.]

An hereditary nervous taint is very frequently present in tabetic disease (fifty-one times in eighty-one cases), and the action of the syphilis upon the nervous system is thereby promoted. Rosenblatt (Dissertation, '93).

In all of thirty-nine cases a previous syphilitic infection was probable; if tabes exist without syphilis, the tabetic virgin must certainly be one day brought to light. Möbius (Centralb. f. Nervenh., Psych., u. gerich. Psychop., Sept., '93).

In Japan syphilis is very wide-spread, while tabes but seldom comes under observation. Grimm (Inter. klin. Rund., Aug. 29, '94).

Of 500 cases of tabes 10.8 per cent. were not infected and 89.2 per cent. were infected with syphilis. Of 50 additional cases, from the lower classes, 12, or 24 per cent., did not show evidence of infection, while 38, or 76 per cent., did.

Concerning other possible etiological causes, or combination of causes, the cases are grouped as follows: Syphilis alone, 27 per cent.; syphilis and cold, 11 per cent.; syphilis and fatigue, 6 per cent.; syphilis and sexual excesses, 9.6 per cent.; syphilis and trauma, 1.7 per cent.; syphilis and neuropathic tendencies, 12 per cent.; syphilis, cold, and fatigue, 13.5 per cent.; syphilis, cold, and excesses, 1.7 per cent.; syphilis, fatigue, and excesses, 0.7 per cent.; syphilis, trauma, cold, or excesses, 1 per cent.; neuropathic tendencies alone, 0.7 per cent.; cold alone, 1.4 per cent.; fatigue, 0.3 per cent.; sexual excesses, 1 per cent.; cold and fatigue, 0.7 per cent.; trauma, 0.3 per cent.; several causes, but not syphilitic, 1.4 per cent.; cases without demonstrable cause, but in several of which syphilis was suspected, 5.4 per cent. Erb (Practitioner, Sept., '91).

Of the tabetic men examined, 56.25 per cent. had certainly had syphilis; and of the women, 66.7 per cent. In 21.90 per cent. of the men and 33.3 per cent. of the women there was, in all probability, syphilis. Gerlach (Fort. der Med., Feb. 1, '91).

Of more than 400 cases of tabes, in about 90 per cent. there was a previous history of syphilis. Gajkiewiecz ("Syph. du Sys. Nerv.," '92).

From a study of the reports of the neurological section of the Charité Hospital, Berlin, it is found that syphilis positively existed previously in 37 per cent. of the cases, most probably in 31 per cent., and possibly in 7 per cent. Kuhn (Inaug. Dissert., '94).

In 30 cases not one found without a history of antecedent syphilis. Schwarz (St. Petersburger med. Woch., p. 259, '89).

There was personally found under the guidance of Leyden, who still denies the etiological significance of syphilis for tabes, among 108 cases, only 20.4 per cent. which were undoubtedly syphilitic and 58.3 per cent. non-syphilitic. Storbeck (Lyon Méd., '95).

Although syphilis could be proved in about 55 per cent. of 225 cases, in many of them it was associated with other causes of tabes dorsalis,—as hereditary joint-affections, alcoholism, sexual excess, etc.: so that the exact percentage which could safely be attributed to syphilis was reduced to 22.33 per cent. Pitres (Lancet, Apr. 13, '95).

In non-tabetic patients above the age of eighteen a history of syphilis was found in only 22.5 per cent., whereas in tabetics it reached 72.8 per cent. There is a close connection between syphilis and tabes; tabes is a consecutive affection to syphilis, somewhat similar to the paralysis which may follow diphtheria. Sarbo (Pester. Med.-chir. Presse, xxxiv. 3 to 5).

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A cause which enters as a possible factor in producing locomotor ataxia is the long-continued and uninterrupted administration of large or even measureably large doses of iodide of potash, which is so commonly given at the present day in the treatment of syphilis. C. T. Drennen (Alienist and Neurol., Oct., '96).

Although syphilis is exceedingly common among negroes, after more than a decade's practice no case of locomotor

ataxia seen. C. S. Briggs (Atlanta Med. and Surg. Jour., Nov., '97).

The exact mode of origin of tabes is still obscure, but the writer rather inclines in the view that it should be classed as a tertiary manifestation of syphilis, though exposure to cold, traumatism, or poisons may call forth or help to bring about the appearance of the disease even in the absence of syphilis. Obersteiner (Berl. klin. Woch., Oct. 18, '97).

The idea is rapidly gaining ground that locomotor ataxia is in no case, perhaps, directly due to syphilis, but to the action of some other poison or poisons, the development or activity of which is favored not only by the presence of syphilitic poison, but by other conditions whereby a morbid state of the body is induced and the resistance of the tissues diminished. Editorial (Modern Med. and Bact. Review, Apr., '97).

The previous history of 47 cases of tabes carefully examined, and in only 8 cases could the writer find no history of syphilis, and in 3 of these preceding syphilis was probable. In 32 cases there was a very definite history of syphilis, and, of these, 10 were only treated for syphilis for a short time early in the disease. In 21 cases there had been a second course of treatment, and in only 1 case had there been repeated intermittent treatment, and then for only one and a half years. In some cases of tabes, when actually established, an antisyphilitic treatment may be of service. Homen (Neurol. Centralb., p. 1026, '97).

Examination of 257 cases of tabes, tending to prove that syphilis is a cause: (1) on the statement of the patient, based on a doctor's opinion; (2) on the former presence of an ulcer with secondary symptoms; (3) on the presence of an ulcer of undetermined character, but followed by secondary symptoms. Cases with a history of soft chancre are put into a separate group. Of the 257 cases (including three women), there was certain syphilis in 38.9 per cent., probable history in 19.8, and a history of soft chancre in 5.8. In 34.2 per cent. syphilis was the only apparent cause. Generally tabes commenced between the fifth and tenth years after infection, and fairly often between the tenth and twentieth years. Tumpowski (Deut. Zeit. f. Nervenh., x, '97).

Series of observations based upon 12 cases of tabes. Syphilis was the cause in the majority of cases, but attention is called to the potency of cold in bringing out the symptoms of a latent tabes. Optic atrophy was present in 2 out of the 12 cases. Ataxia and pains were often absent in these cases. Bladder-symptoms were often among the earliest manifestations; they appeared as irritability of the organ or as weakness of the sphincter or detrusor. Two exhibited tabetic arthropathy, which assumed the hypertrophic or benign form of Marie; in 1 case there was a spontaneous fracture. Aortic disease was present in 2 cases. Trevelyan (Quart. Med. Jour., July, '98).

In a series of 61 cases a history of syphilis was given in 31 of 49 cases examined. In the other 18 there was evidence of possible exposure to the disease. In the remaining 12 syphilis was either denied or the point was not determined. In most of the cases the initial symptoms of ataxia appeared in from eight to fifteen years after syphilis had developed. In 2 cases the disease followed soon after mechanical injury. A history of exposure to wet and cold was given in 7 cases; 1 case developed immediately after typhoid fever. In 29 cases the disease first appeared between the ages of thirty and forty. In 2 cases it began at the age of 25, and in the 1 following typhoid fever at 22 years. In 37 cases the initial symptom was pain in some part of the body, usually described as rheumatic. In 3 cases it was gastric crises; in 3 cases laryngeal crises; in 4, ineo-ordination of the lower limbs. W. H. Riley (Jour. Nerv. and Mental Dis., Sept., '98).

Following facts mentioned as antagonistic to the syphilis theory of tabes: 1. The rarity of tabes dorsalis among the Kirghiz of Central Asia, despite the fact that syphilis is very common. 2. Syphilis is common among negroes, but tabes is almost unknown. 3. In Bosnia and Herzegovina syphilis is extremely common, but tabes rare. This is true also of Abys-

sinia. Among the Arabs, despite the frequency of lues, general paralysis is rare. Tabes is also rare among prostitutes, although most of them are syphilitic. S. H. Scheiber (Deut. med. Woch., Sept. 22, '98).

The factors of age and sex are of interest. The disease is one rather peculiar to the period of virile manhood, the years between 25 and 45 showing, by far, the largest number of cases. True locomotor ataxia rarely, if ever, occurs in childhood.

Ten cases of true tabes in childhood. In six cases the disease began before the tenth year, and in four between the tenth and fourteenth years. In the majority of cases hereditary syphilis was not indicated. Hildebrandt (Ueber Tabes Dorsalis in Kindersalter, '92).

Males are more liable to the disease than females in the ratio approximately of 10 to 1. Climate and race are unimportant factors, though, in my personal observations, out of 34 cases, 14 were Irish or Irish-Americans. The negro has been considered heretofore as rather peculiarly exempt from posterior spinal. This exemption, it seems, is apparent rather than real, at least in large degree, the disease probably occurring much oftener in the negro than hitherto supposed, but escaping recognition because of the anomalous clinical form—amaurotic tabes—in which it appears in this race. McConnell has recently published the records of five cases of tabes in pure-blooded negroes—the only cases observed in negroes in eight years' service at the Philadelphia Polyclinic, all of whom exhibited the amaurotic type.

Statistics of 1642 cases of nervous disease of all kinds, there being 496 male and 264 female Russians: also 449 male and 433 female Jews. Among the male Russians 25 per cent. were syphilitic, and among the females 11.4 per cent.: among the Jews only 7 per cent., and among the Jewesses only 1.5 per cent. Among the Russians of both sexes the proportion of tabes was five times greater than among the Jews. Minor (Neurol. Centralb., July 1, '92).

Pathology.—Ordinarily the gross macroscopical appearances observed post-mortem in this disease are both conspicuous and constant. The cord is flattened antero-posteriorly from shrinkage in the posterior columns, which are also unnaturally gray in color. Microscopically the nerve-tissue proper is found to be sparse or to have almost completely disappeared in certain localities, its place having been taken by an overgrowth of connective tissue. The area most affected is that of the lumbar enlargement and lower dorsal region, and the fibres which exhibit the greatest damage and destruction are those of the columns of Gall and Burdach and the Spitzka-Lissauer tract. Higher up, and as the disease advances, similar changes are noted in Clarke's vesicular tract. Gowers's sensory tract in the antero-lateral field is quite often involved and sometimes quite early. Less constantly the direct cerebellar tract shows similar degenerative changes; but implication of the crossed pyramidal fibres or Turck's columns occurs only as a complication.

Case of a man, aged 31, who died two years after his first symptoms of tabes, which consisted of crises of pain chiefly localized in the right side of the thorax, slight inco-ordination, abnormal pupillary reactions, abolition of the knee-jerks. The post-mortem examination revealed a normal condition of the peripheral nerves and the meninges, but in the cord a sclerosis, beginning in the dorsal region and increasing in intensity upward to cervical, limited to the median portion of the column of Burdach. This sclerosis was purely neuroglial, and independent of vascular changes. Raymond (La Sem. Méd., Mar. 14, '91).

The posterior roots and ganglia are

also involved, sometimes quite extensively. If the disease has been of long duration and has reached the paralytic stage, the anterior gray horns are apt to show degenerative changes in both fibres and cells.

Destruction more or less complete of the nerve-elements in the posterior horns is quite often apparent microscopically. Autopsies have been reported from time to time in which extensive degenerative disease of the peripheral nerve-fibres or neuraxons has been noted, but such peripheral changes have been considered, until recently, as of secondary rather than primary importance. Pathogenetically the disease has been considered as primarily of vascular origin, an exudation of lymph leading to a proliferation or neoplastic infiltration of the neuroglia or connective tissue, with consequent compression and, ultimately, structural disintegration of the nerve-fibres. This represents a *résumé* of the older and hitherto-accepted teachings as to the pathology and morbid anatomy.

Recent methods of pathological research with the correlated studies in this field of Cajal, Van Gehuchten, Marie, Redlich, Hodge, and others have, however, brought to light facts which demand modifications of these views so radical as to be almost revolutionary. The exact pathogenesis of tabes is as yet an incomplete chapter in the history of this disease, but enough has been proved to demonstrate that it is *not* a primary sclerosis of the posterior columns. The recognition and acceptance of the theory of the neurons was an important step in establishing this fact. According to the newer teaching, the disease is a centripetal parenchymatous atrophy or degeneration of sensory neurons followed secondarily by sclerosis, due to nutritional disturbances, which, according to Marie, affect first the ganglia on the posterior roots.

These ganglia, it will be remembered, are the trophic centres, not only for the sensory nerves, but for the neuraxons, or axis-cylinder processes, of the dorsal columns of the cord. The neuron of the posterior spinal ganglia is a flask-shaped body, having an axis-process, or neuraxon, which divides into two branches, one of which passes within the nerve-sheath to the periphery, forming an arborized or brush-like net-work of distribution in the skin or muscle-spindles. The other branch passes, with the posterior root, into the cord, dividing there into two branches, one of which ascends, while the other descends, in the posterior column. From both of these branches smaller fibres are given off which terminate in the posterior-horn gray matter. Some of these smaller fibres are short, others quite long, extending as far as the medulla, where they end in terminal arborizations. Marie divides these fibres into three sets:—

1. Short fibres which pass directly into the posterior horns after entering the cord.

2. Fibres of medium length which run upward in the cord, some of them ending in the middle posterior horn, others passing into Clarke's column. These fibres are contained in the fasciculus cuneatus of Burdach.

3. Long fibres coming chiefly from the roots of the cauda equina, passing thence the full length of the cord to the medulla and forming the fasciculus gracilis of Gall.

Marie's theory is as follows: "The changes found in the tabetic spinal cord are not the result of a primary systemic myelopathy; they are the expression of a progressive degeneration of the posterior-root fibres; these medullary changes in

tabes occur in segments, while each diseased posterior root furnishes a new contingent of degenerated fibres to the spinal cord." The initial cord-lesion is found in the dorsal-root zone and the Spitzka-Lissauer tract, due, Marie believes, to degeneration through the medium of the short (1) fibres. The degeneration in the columns of Burdach and Clarke's columns, which is usually proportionate in degree to the duration of the disease, occurs through the medium of the fibres of the second group. The sclerosis observed in the columns of Gall he attributes to the degeneration of the long fibres of Group 3. Primary disease of the ganglia of the dorsal roots affords the explanation for the peripheral neuritis, which is parenchymatous and not interstitial, and is the result of disease of the trophic centre of the peripheral nerve in the posterior ganglia. Marie, while maintaining this view, most strenuously admits that no evidence whatever of disease of the spinal ganglia is found in some cases, but it is quite possible to assume that very subtile and slight trophic changes at this point, although unrecognizable, are sufficient to produce the changes in the distal arborizations of the sensory neuraxons in the muscle-plates and skin, and in the cord which are farthest removed from their nutritional centres, which changes give rise to the lightning pains, the diminished knee-jerks, pupillary changes, the vesical and sexual symptoms, and other sensory and trophic disturbances which mark the incipient stages. The studies of Déjerine, Wallenberg, Rousoni, Blocq, Trepinski, Obersteiner, and Redlich, as well as the very interesting and important observations of Sherrington, Batten, and others as to the relations in health and disease of the distal-nerve arborization in muscle-plates and muscle-spindles to the muscular sense and its perversions, are all distinctively corroborative of this theory.

The relationship of syphilis etiologically occurs, according to the views of Obersteiner and Redlich, through the presence of thickening of the pia, from old leptomeningitis presumably, which, by compressing the dorsal-root fibres at a point of lessened resistance, leads to their degeneration. Further discussion of this very important subject, while exceedingly interesting, would be without present advantage in the absence of further proof, which is needed before a final acceptance of these views in their entirety is admissible.

> Tabes is being regarded less and less as a disease limited to the cord, and it is even doubtful whether the lesions of the posterior columns are primary. The tendency of accumulating facts is to the effect that they are secondary to neuritis of the posterior roots; that tabes presents more and more the appearance of peripheral disease of the sensory and motor nerves and the nerves of special sensation. Déjerine (La Méd. Mod., Mar. 20, '90).
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> In a great number of tabetic spinal cords the affection of the posterior columns and of the posterior horn in this disease conforms itself in every detail to the intraspinal course of the posterior-root fibres. Redlich (Psych. Jahrbucher, vol. ii, '92).
>
> Tabes is to be considered as a primary sclerosis by successive degeneration of the nerve-fibres and cells. Its progressive character admits of the supposition that a poison may be present in the body which constantly influences the diseased tissue (toxin theory). Dana (N. Y. Med. Jour., Jan. 9, '92).
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> The causative condition of tabetic disease of the spinal cord is to be found in a compression of the posterior roots, at their point of penetration into the spinal cord, with consecutive ascending degeneration of their intramedullary prolongations. Obersteiner and Redlich (Arbeiten aus den Inst. f. Anat. u. Phys. des Centralnerv. in Wien, '94).
>
> There is a constriction or snaring of the

posterior roots by a process which may be termed inflammatory, causing degeneration of the posterior columns; but the point of the tightening pressure, however, is not established at the spot where the root extends through the pia mater, but rather at the passage of the outer spinal meninges, where the dura mater and arachnoids lie closely against the pair of roots, in funnel shape, inclosing the same as far as the spinal ganglion. At this point in tabes is found a perineuritis with nuclear proliferation and consecutive sclerosis. This occasions a circular tightening of the roots by which these, and particularly the posterior roots, are very much injured. Nageotte (Bull. de la Soc. Anat., Nov. 16, '94).

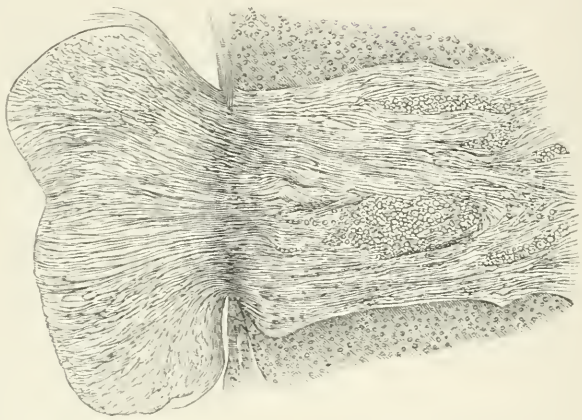
Changes found by Nageotte frequently occur in tabes at the point indicated, but they are of no importance as far as the degeneration of the posterior roots is concerned, since the latter show the same degree of degeneration, both in front of and behind this point, in a longitudinal section. Obersteiner (Arbeit. a. d. Inst. f. Anat. u. Phys. d. Centralnerv., No. 3, '95).

[Modern views concerning the condition of tabetic disease of the spinal cord may be summarized as follows: That we have here to deal with a secondary degeneration of the intramedullary prolongations of the posterior roots, the initial point of this degeneration being as yet undetermined. H. Obersteiner, Assoc. Ed., Annual, '95.]

Pathological changes demonstrated in the cerebellum in all of the six cases of tabes personally examined—for instance, atrophy of the nerve-cells in the corpus dentatum and degeneration of the medullary fibres in the lobules. Tellinek (Deut. med. Zeit., Mar. 26, '94).

[Degeneration of the spinal trigeminus root in tabes is not by any means rare, and the ascending root of the glossopharyngeus nearly always degenerates simultaneously. H. Obersteiner, Assoc. Ed., Annual, '95.]

The condition of tabetic arthropathies is one of trophic degeneration without inflammation. Parker Syms (N. Y. Med. Jour., Jan. 19, '95).



View of a normal posterior lumbar root at its point of entrance into the spinal cord. At the spot where the root is tightly compressed by the pia mater it appears darker, while the medullary sheaths are much thinner or are totally absent. (*Obersteiner.*)

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[The pathogeny of tabetic arthropathy is still shrouded in mystery. Doubtless the interchange of action between the sensory and vasomotor nerve-functions is disturbed by the pathological conditions in the nervous apparatus, but it is still a question whether the neurotic arthropathies are referable to such a disturbance; perhaps there is merely a condition of ordinary arthritis deformans which has undergone a decided modification owing to the lesion of the nervous

system. H. Obersteiner, Assoc. Ed., Annual, '96.]

The lesion of tabes has its origin in the posterior roots just at their point of union with the cord. This is anatomically a *locus minoris resistentiæ*; what precise exciting cause of the change is has to be decided. Redlich (Die Pathol. der Tab., Hinter. ein Beit. zur Anat. und Pathol. der Rucken., p. 6, 205, Jena, '97).

Tabetic processes classified as interstitial and parenchymatous. The former is regarded as entirely secondary to the latter, which is the primitive change. It affects the posterior roots and posterior columns, but leaves the intervertebral ganglia intact. The change affects the myelin sheath, bringing about a segmentation and granular degeneration, resulting in atrophy. The nuclei of the nerves are not multiplied, but the exact condition of the axis-cylinder was not determined. It probably remains more or less intact for a long time. The evolution of tabes follows two types: the benign and the grave. In the latter the lesion is in the cord, resulting in very rapid destruction of the endogenous zones of the posterior columns, both ascending and descending. In the former, on the other hand, the lesion is in the posterior roots, outside the cord, and has little tendency to spread. It is these that especially exhibit pains, while numbness and tingling indicate rather an affection of the cord. Philippe (Arch. de Neurol., Sept., '97).

In locomotor ataxia there is a lowered vitality of the nervous apparatus, inherited or acquired, resulting in defective nutrition of the neurons. The neurons are the first to exhibit signs of malnutrition in parts farthest removed from their affected nutrition-centres in the posterior spinal ganglia, viz.: the cutaneous spinal-cord arborizations, respectively. Mottler (N. Y. Med. Jour., Oct. 15, '98).

Complications.—Locomotor ataxia is quite frequently encountered in association with general paresis. Either of the two may appear as the primary disease, the other occurring in such cases as a complication. Hemiplegia is also not very uncommon. Through an extension of the disease-process other areas of the cord may be involved, and symptoms of lateral sclerosis, progressive muscular atrophy, etc., may be added to the original picture. Phthisis, heart disease, and nephritis are occasionally found coexistent, though not in any essential relationship.

In a male patient the very unusual combination of tabes with paralysis agitans noted. Placzek (Deut. med. Woch., July 7, '92).

Atypical cases of tabes in which, with the sudden appearance of hemiplegia on the left side, there were also pronounced symptoms of paralysis agitans. Raichline (Jour. de Méd., July 28, '95).

Dementia paralytica and true tabes are only rarely combined, but the former affection may begin with spinal symptoms which simulate tabes; it is then merely a pseudotabetic process with a different condition in the spinal cord. Joffroy (Nouv. Icon. de la Salpêtrière, No. 1, '95).

Exophthalmic goitre and diabetes have also been observed.

The relation existing between tabes and diabetes may vary in character; diabetes being present, certain symptoms of tabes may occur, or during the course of tabes sugar may appear in the urine. There is, besides, relation between true tabes and true diabetes, through the fact that these diseases occur in various persons of the same family, in consequence of an hereditary nervous taint, both appearing at times in the same subject. Blocq (Revue Neurol., Apr. 30, '94).

The association of exophthalmic goitre with tabes is more than a mere coincidence. It is due to bulbar disturbances, possibly from congestive hyperæmia. Marie (La Sem. Méd., Dec. 19, '88).

Two cases in which tabes was combined with Basedow's disease. Thimotheeff (Thèse de la Faculté de Paris, '93).

In a case of tabes combined with Basedow's disease there was found degeneration of the ascending roots of the trigeminus and of the glosso-pharyngeal nerve. Marie and Marinesco (Revue Neurol., May 30, '93).

Prognosis.—The disease has been heretofore considered essentially chronic and progressive and the prognosis as regards cure extremely unfavorable. The degree to which the newer discoveries and correlated teachings in pathology will modify this conclusion has not yet been fully determined. It can, at best, affect the prognosis favorably only when the disease is recognized and properly treated promptly and in its incipiency. Well-established locomotor ataxia will, in all probability, remain, as heretofore, a chronic progressive practically incurable affection.

The duration of the disease is very variable, extending over a period from twenty to thirty years in some instances. It is rarely the cause of death *per se*, a fatal termination occurring usually through the medium of some intercurrent affection, such as cystitis, pyelitis, trophic disorders, hypostatic pneumonia or bronchitis, or a profound asthenia.

Much in the way of symptomatic relief may be promised from intelligent treatment, and in some cases long periods of arrested progress may be obtained. Coordination can be materially improved and the pains and crises relieved. Spontaneous amelioration of symptoms may occur and spontaneous remissions in the progress of the disease have been frequently noted, but such results are much more positively assured from treatment. Usually the pains tend to become progressively less as the disease advances, the explanation being obvious in a progressive diminution in sensory function.

Less easy of explanation, but none the less a fact, is the lessening and sometimes marked improvement in the ataxic and painful symptoms which attends the onset of blindness. The greater amount of rest—enforced rest—affords a probable partial explanation. The development of severe trophic symptoms is an omen of evil and may be the precursor of the end. Pseudoparalytic or actual paralytic helplessness may develop in the late stages and superinduce a fatal asthenia. Cases with well-marked and frequently-recurring crises, especially gastric, cardiac, and respiratory, are said to run a shorter average course. The etiological element in individual cases does not apparently modify the prognosis to any appreciable extent. Freedom from want and worry, on the other hand, are materially advantageous to the possessor who is a victim of this disease. In my personal experience, which is, however, insufficient for positive deduction, the disease runs a far more rapid course in women than in men.

Treatment.—There is no specific known to be effective in curing locomotor ataxia, and this is true even of the cases positively due to syphilis. Iodide of potassium and mercury in various forms alone or in combination have proved equally inefficient, at least as regards anatomical cure, though, occasionally, in acute cases especially, an arrest of progress has been attributed, and probably correctly, to these agents. In cases in which, by intuition or good fortune, rather than by applied diagnosis, the disease has been recognized in its very incipiency, the prompt and proper administration of either of these drugs might prove positively curative and is certainly worthy of employment. The uncertainty of diagnosis would, however, render conclusions as to the curative value of these drugs at least a problem.

> Cases of tabes of rapid course treated early by large doses of mercury (inunctions) and potassium iodide, with persistent and complete cures; 4 cases cited. Germeix (Archives de Méd. et de Pharm. Milit., Jan., '89).
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> Mercury accomplishes nothing in tabes. The irregular course of the disease gives

rise to the illusions concerning its efficacy. Charcot (La Sem. Méd., June 4, '90).

Mercury may modify the syphilitic lesions so as to possibly hold the tabetic trouble to a milder grade, and, therefore, should be tried, but we should not expect it to affect the tabetic degenerations already existing. Strümpell (Münch. med. Woch., Sept. 30, '90).

Case of locomotor ataxia of syphilitic origin cured by specific treatment. Gaucher (La Sem. Méd., July 16, '90).

The idea that antisyphilitic treatment in tabes is useless or even hurtful is erroneous. Personal improvement of one or several symptoms found in fifty-eight of seventy-one cases of tabes, after the use of mercury; there were no results in eleven cases, and only in two did aggravation of the symptoms occur. Heidelberg (Berliner klin. Woch., Nos. 15, 20, '93).

Marked improvement in an already advanced case of tabes, by the administration of large doses of iodide of sodium, as high as 2 drachms per day. Max Weiss (Centralb. für die Gesammte Ther., Feb., '94).

There is little if any evidence in clinical experience tending to confirm the claims advanced as to the curative merits of the salts of silver and gold, of ergot, of arsenic, or of the many other vaunted specifics which appear in the older literature of this disease.

Eleven tabetic patients treated by hypodermic injection of nitrate of silver. There was hardly any appreciable improvement except in 1 case, in which the improvement was very decided respecting the pains, ataxia, and vesical and rectal symptoms. Rosenbaum (Deut. med.-Zeit., May 15, '90).

Phosphate of sodium used in a number of cases with surprising results. A solution of 1 3/4 grains of the salt in 15 1/2 minims of cherry-laurel water is injected close beside the lumbar vertebral column. According to the severity of the disease, one or two injections are made daily. After twenty-five applications the improvement is very noticeable, and after fifty very pronounced. Forbes Winslow (Lancet, Nov. 18 *et seq.*, '93).

Happy results attained with phosphate of sodium. A. Cordes (Lancet, Nov. 25, '93).

In case of tabes an injection of Koch's tuberculin was given, and repeated in two days; the treatment followed for three weeks. Pains were increased at first, then rapidly diminished, until, at the end of three weeks, they had entirely gone. Co-ordination was much improved, and his strength greatly increased. Another case showed great improvement under similar treatment. Neilson (Med. and Surg. Reporter, May 30, '91).

Great stress laid on the use of warm baths (temperature, 95° to 86° F.), the duration of which should be from five to twenty minutes. Three kinds of baths are employed: (1) the simple warm bath; (2) brine-baths containing CO_2; (3) sweating-baths and vapor-baths. The first and third kinds are suitable in the early stages of tabes, the second in the more advanced stage. Leyden (Inter. klin. Rund. Dec., '89).

Plea for the cold-water treatment of spinal diseases. Cold affusion to the lower extremities is of value, these parts having been previously warmed by the hot pack or by steam-baths. The cold should not be applied for more than a minute, after which the parts are dried and covered for half an hour with dry blankets. This treatment has proved especially efficacious in tabes. R. von Hoesslin (Balneol. Centralb., Oct. 16, '91).

In locomotor ataxia lukewarm baths, with pine-needle extract, or half-baths with affusion, are indicated. Hot sand- or water- bags are sometimes applied continuously to the spine for one or two hours, with the purpose of increasing the temperature and circulating activity of the cord. Dana (Dietetic Gaz., Dec., '91).

Use of suggestion proposed for tabes. Without its being in any way possible to influence the organic changes in the nervous system, one may yet be able to remove a number of functional disturbances and to materially help the patient. Bérillon (Congrès Français des Méd. Alienists et Neurol., '95).

In the majority of apparently-organic nervous affections there is also a func-

tional psychical factor; this explains the wonderful improvement in organic cerebral lesions under hypnotic influence,—*i.e.*, suggestion. H. Obersteiner (Wiener klin. Woch., No. 17, '95).

The method of suspension, while effective in exceptional instances in modifying, at least, temporarily, certain obtrusive symptoms, has not survived the test of time, and, indeed, is to-day condemned as often positively harmful.

Suspension may cause untoward effects in the early stages of tabes, as by this means the meningeal hyperæmia is heightened. Of all the symptoms of tabes, impotence is the one apparently most influenced. Aravena (Boletin de Med. de Santiago, Oct., '92 to Feb., '93).

The lancinating pains and crises occasioned by the pressure upon the nerve-roots and even the transitory improvement caused by suspension and nerve-stretching, are explainable through the fact that the tension brings about a loosening of the compressed, swelled connective tissue. Obersteiner and Redlich (Arbeit. aus den Inst. f. Anat. u. Phys. des Centralnerv. in Wein, '94).

Suspension considered as a useful measure in a number of cases; certain symptoms are improved, as, for instance, pains, sexual weakness, and incontinence. De Forest Willard and Guy Hinsdale (Med. News, Nov. 24, '94).

Case of a tabetic patient who was obliged to use a wheel-chair; suspension was resorted to every other day during a long period (several years). After from fifteen to eighteen months he was able to walk with two canes, and after three years he could walk alone, play croquet, etc. The bladder and rectal symptoms also disappeared under this treatment. Hugh Cuthbertson (Canadian Pract., Nov., '94).

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The following points given as the chief aim in the treatment of tabes: Active antisyphilitic treatment if the indication exists, the use of tonics, and electricity; hydrotherapy in its various tonic forms, the use of electrotherapy and suspension, care being taken not to neglect symptomatic treatment. Later, if the indications still exist for active antisyphilitic treatment it is to be used, although such good results cannot be expected from it. Careful regulation of the diet should be insisted upon, and hydrotherapy, electricity, with gymnastics, suspension, and psychical treatment should be utilized. If the disease is very far advanced and the patient is much incommoded in his movements, it is important to maintain his mental tone by every encouraging method that one possesses, and to use medication which will combat the disagreeable or painful symptoms. Erb (Revue de Thér., May 1, '97).

By causing a sitting patient to bend forward strongly with the hands outstretched, a true strong elongation of the spinal cord to the extent of about $^2/_5$ inch takes place, and this elongation occurs mostly in the lumbar region. The writers have, therefore, constructed an apparatus so that the bending may be brought about forcibly without interfering with the breathing or circulation. It was tried in the second stage of the disease, in thirty-nine men and eight women; cases of very long duration were excluded as well as cases of very rapid onset, or if in the third or paralytic stage. Good results were obtained in half the cases; the sensory irritations and lightning pains were improved, retention of urine was relieved, but incontinence was less influenced. Almost always the gait improved, and ten patients were able to walk again alone; on the eyes and bulbar symptoms the stretched had very little influence. Ten patients were not benefited. Each stretching was kept up for eight or twelve minutes, and repeated fifteen to twenty times. Improvement showed itself mostly at the tenth to the fifteenth sitting. The treatment was never continued for longer than three or four months or forty to fifty sittings. Gilles de la Tourette and Chipault (Prog. Méd., p. 278. '97).

In the treatment a favorable impression was gained from the use of large quantities of water for purposes of flush-

ing out the system. Patients are instructed to drink from 5 to 7 pints of water daily. Hydrotherapy, especially warm baths, electricity, massage, and other mechanical movements, including suspension treatment, are valuable. W. H. Riley (Jour. Nerv. and Mental Dis., Sept., '98).

The therapeutic life of the animal extracts in this disease was equally short and inglorious. In the absence of any specific our efforts are limited to two indications: the retardation in progress of the disease and the palliation or control of symptoms. Much can be done in both directions. Three remedial measures stand out conspicuously in a host of failures as having a certain and established value. These three are rest, electricity, and the Frenkel method of "re-education." Conjointly and intelligently employed, the results are positive and at least relatively satisfactory. The degree of rest necessarily varies. In the incipient stage the severity and frequency of the pains and other sensory symptoms should be the guide. Five or six weeks of absolute rest in bed is ordinarily sufficient. The return to active exercise should always be tentative and gradual and for months or even years the amount of physical exercise should be carefully guarded. Any evidence of an aggravation of the disease should be interpreted as a danger-signal, demanding a return to absolute rest. In the ataxic stage the same rule should apply, though with less rigor perhaps, since the results to be obtained are less important. I have seen the pains, the ataxia, the disturbances in sphincteric control and the various crises either greatly lessen in severity or entirely disappear from prolonged absolute rest. Next in order to rest is galvanism. Of the value of static electricity I have no personal knowledge. Faradism in my experience is quite often and perhaps always positively harmful. Galvanism should be employed daily. The current should not exceed at first 5 milliampères. The *séances* should at first be limited to ten or twenty minutes, gradually lengthened to one or even two hours, daily. The electrodes (Erb) should be applied to the spine, thoroughly wet, of course; one over the upper dorsal region, the other over the upper sacral spine. The selection of the pole is immaterial in my experience. Occasionally it is of advantage, if the pains are severe or the ataxia of station or gait extreme, to apply the electrodes one under the sole of each foot, the current making the direct circuit of the nerves chiefly affected.

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Rest is the most important part of the treatment. In the severer cases the patient should be in bed for weeks, whereas in the milder ones a few hours a day in bed may be sufficient. The amount of rest required varies greatly with different individuals. Antisyphilitic treatment often proves most valuable. Landon Carter Gray (N. Y. Med. Jour., Mar. 12, '97).

More than one-half the cases of locomotor ataxia may be almost completely arrested in the incipient period of the disease, and nearly all are more or less amenable to treatment, if this is instituted before the patient becomes greatly exhausted, or before he has to take to his bed. J. T. Eskridge (Charlotte Med. Jour., Dec., '98).

A rest treatment may be essential for the best results in a stubborn advancing case. Such patients should never exercise to tire, and should be in the fresh, dry air much, especially at great altitudes. Massage and electricity properly applied are most valuable. The use of a stimulating liniment rubbed well over the surface of the body has proved also of great value in stimulating circulation.

The following may be used:—

℞ Ammonium chloride, 3 drachms.
Glycerin, 1 ounce.
Tincture of capsicum, ½ ounce.
Peppermint-water, q. s. to make 12 ounces.

M. Rub on the body daily for twenty minutes, with massage. Savary Pearce (Therap. Gaz., Oct. 15, '98).

Frenkel's method consists essentially and in principle in the redevelopment, through certain exercises, of muscular co-ordination. Its usefulness is limited to the diminution of one symptom (ataxia) alone. Frenkel's special apparatus is not essential; any improvised procedure which observes and preserves the principle is sufficient and equally effective.

Method of treatment recommended for ataxia of the upper extremities. It is first necessary to determine which muscular groups are affected, and it is particularly important to know whether the shoulder-muscles are involved. Ataxia in the last-named region usually disappears readily and quickly under treatment, while that of the forearm and hand is corrected with more difficulty. A series of different apparatuses constructed for this purpose; the patient must, for instance, insert a number of pegs in a plate provided with holes, catch swinging leaden balls, etc. The practice should be varied so that the patient may not grow fatigued and lose interest. They must also resume certain occupations (the fastening of their clothes, writing with pen and ink, piano-playing, etc.) in case they have, for greater ease, given these up. Even in pronounced cases of ataxia very good results may be expected; the moral effect of the treatment is also quite considerable. The improvement noticed by the patient and the physician exerts a powerful influence upon the disposition, sleep, and general condition. The sensibility of the skin and muscles also improves under this treatment. Frenkel (Zeitsch. f. klin. Med., B. 28, '95).

Literature of '96-'97-'98.

Frenkel's method of curing ataxia by re-education of the movement used in nine cases. The exercises were performed once daily for about half an hour, and later for an hour; but the latter time should never be exceeded, nor should the patient be tired. In three of the cases the ataxia was so severe that there was total inability to walk or stand; in the remaining cases the ataxia was of the middle grade. In all the cases there was an improvement and in some a considerable improvement. Acute cases are not benefited until the case has reached a more stationary period. Hirschberg (Arch. de Neurolog., vol. ii, Nos. 9-11, '96).

For exercising the upper extremities the following directions are given: Sit in front of a table, place the hand upon it, then elevate each finger as far as possible; raise the hand slightly, extend, and then reflex each finger and thumb as far as possible; do this with the right and then with the left hand. Touch with the end of the thumb each finger-tip separately and accurately; then touch the middle of each phalanx with the tip of the thumb. Sit at the table with a large sheet of paper and a pencil; make a dot at each corner of the paper and one in the centre, and draw lines from the corner dots to the centre dot, first with the right and then with the left hand. Put ten coins on the paper, pick them up and place them in a single pile, first with the right and then with the left hand.

For the body and legs, sample exercises: Sit in a chair, rise slowly to erect position without help of cane or arms of chair; then sit down slowly; stand with cane, feet together; advance left foot and return it, then the same with right. Walk slowly ten steps forward and five back with help of canes. Stand without cane, but with feet a little apart and the hands on the hips; in this position stoop down by flexing the knees, and rise slowly. Stand without cane with the feet separated; raise the hands from the sides above the head; carry them downward and forward, and try to touch the toes. Walk along a fixed line on the floor by help of cane, placing each foot in turn on the line; then repeat without using the cane. Most of these exercises should be repeated several

times, and the movements should be made with the eyes both open and closed.

Owing to disturbance of the sensory paths tabetics have lost the sense of fatigue, so there is some danger in overdoing the treatment. Two things are therefore insisted upon: first, every movement must be done with the greatest possible exactitude, and, second, the *séance* should not last more than eight or ten minutes, and no more than two should be allowed a day.

The treatment is absolutely contra-indicated in cases of acute or subacute ataxia. Frenkel (Deutsche med. Woch., Dec. 17, '97).

All cases of locomotor ataxia are benefited by the exercise treatment, many to the degree of apparent recovery, unless there are special contra-indications to the treatment.

Contra indications are: loss of vision, mental impairment, bone- and joint- disease, spasticity, and muscular atrophy, the presence of strong irritation-symptoms, rapid progress of the disease, a state of great exhaustibility, and serious organic disease.

In cases of anæmia, poor nutrition, and lax joints these conditions should be remedied before the treatment is instituted.

The conditions most favorable for the treatment are: a stationary or almost stationary state of the disease, good general health, intelligence, hopefulness, and perseverance.

Light cases are more amenable to a (practical) cure, but bad, even bedridden cases often give brilliant results.

The necessary duration of treatment varies from a month or more for the lightest to six months or a year for bad cases, but the exercises must be kept up in order to insure the continuance of the improvement.

Success of treatment depends upon thorough knowledge of the method.

Exercises should be chosen most suitable to the existing ataxia, and every effort should be made to do them with the greatest precision.

The sense of fatigue is often blunted in ataxics, while overfatigue injures them. The patient should, therefore, be guarded against too taxing or too prolonged exercises, or other unnecessary efforts.

To obtain most benefit from the treatment, the constant supervision of the physician, at least in its early periods, is absolutely necessary. Zenner (Cincin. Lancet-Clinic, July 16, '98).

Not very obvious results noted from antisyphilitic remedies, though a course of them should always be tried in early cases. A short course of arsenic may also be advisable, and some good had appeared to result now and then from the use of testicular extracts. Galvanism along the spine and hydrotherapeutic treatment may also at times prove of service. For the ataxia, the best results are obtained by the method of graduated exercises as practiced by Frenkel. Trevelyan (Quart. Med. Jour., July, '98).

At times the pains are so severe as to require immediate relief. Hot sitz-baths, the cold pack, ice-coils to the leg or an ice-bag or the cautery to the spine, may be tried with or without any one of several anodynes, the most reliable of which are antipyrine, antifebrin, phenacetin, or codeine. Morphine should be employed as a last resort and should be administered hypodermically.

Exalgin used in the treatment of the lightning pains of locomotor ataxia; doses of from 4 to 12 grains ordinarily employed. Desnos (Revue Gén. de Clin. et de Thér., Feb. 15, '91).

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For the lightning pains of locomotor ataxia the following may be administered:—

℞ Antipyrine, 10 grains.
Phenacetin, 3 grains.

M. Make one cachet.

Sig.: Take one cachet every fifteen minutes, until three have been taken. Déjerine (Méd. Mod., p. 797, '97).

For the relief of the various crises, symptomatic remedies are used. Full doses of oxalate of cerium usually relieve promptly the vomiting in gastric crises.

Heart-tonics, such as caffeine, strychnine, etc., may be indicated in involvement of the vagus. Cystitis complicating locomotor ataxia may be treated symptomatically as an ordinary cystitis with relief. Trophic lesions are occasionally quite intractable. Strychnine in doses of $^1/_{30}$ to $^1/_{16}$ grain will at times retard the progress of an optic atrophy. Strychnine should, however, be given always with caution in this disease.

Antipyrine or phenacetin, 15 grains per dose, recommended when optical atrophy appears. Hutchinson (Archives of Surg., Jan., '94).

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Case in which, after increasing doses of Fowler's solution, spinal-cord stretching, and static electricity had failed, strychnine nitrate was used. Strychnine nitrate, 1; glycerin, 240; water, 240; employed hypodermically. The initial dose was $^1/_{48}$ grain (10 drops of the above solution), which was increased until a dose of $^1/_6$ grain was reached; next, beginning with the initial doses, it was increased until $^1/_3$ grain was attained. Again, starting with the initial dose it was doubled, and trebled, until $^3/_5$ grain was taken at a dose. Under this treatment the pains did not return, the man could walk with the aid of a cane, and his general symptoms improved. Emil Altman (Post-graduate, No. 7, '98).

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LUMBAGO. See RHEUMATISM.

LUNGS. See PULMONARY.

LUPULUS.—Lupulus (humulus, U. S. P.), or hops, is the strobiles or fruit-cones of *Humulus lupulus* (order *Urticaceæ*). The glandular powder adhering to the axis and bracts is called lupulinum and is the most important part of the plant. Hops contain a liquid, volatile alkaloid (lupuline [?]), a bitter principle (lupulinic acid), 1 per cent. of volatile oil, 9 to 18 per cent. of resin, 3 to 4 per cent. of tannin, a fermentable sugar, diastase, and a small amount of asparagin.

Preparations and Doses. — Humulus (hops), not used internally.

Tinctura humuli (20 per cent.), 1 to 4 drachms.

Infusum humuli (non-official, 4 drachms to 1 pint), 1 to 4 ounces.

Lupulinum, 5 to 15 grains.

Extractum lupulinum fluidum, 10 to 30 minims.

Oleoresina lupulini, 2 to 7 minims.

Therapeutics.—STOMACHIC TONIC.—Hops is useful as a stomachic tonic, and may be given for the purpose in an infusion (hop-tea), using a half-ounce to the pint of boiling water, of which almost unlimited quantities may be given. It is useful in simple flatulent colic; atonic dyspepsias, and mild diarrhœa. The infusion given in doses of $^1/_2$ to 1 wineglassful, before meals, increases the appetite and aids digestion. The infusion diluted with twice its bulk of water is useful as a summer drink and to quench the thirst in mild febrile affections.

SEDATIVE.—The tincture of hops and the oleoresin of lupulin are of great value in mild cases of delirium tremens, as they act both as a stomachic tonic and as a cerebral sedative. Bartholow suggests as a substitute for alcoholic stimulants:—

℞ Fluid extract of lupulin,
Tincture of capsicum, of each, 1 ounce.

Of this mixture 1 or 2 teaspoonfuls are given as necessary. The condition known as "horrors," or the wakefulness and excitement of the prodromal stage of delirium tremens, may often be re-

moved by the free use of this combination. Infusion of hops is also useful during recovery from a debauch or during treatment for alcoholism or the opium habit.

Genito-Urinary Irritation. — In all kinds of irritation of the genito-urinary tract it is useful. Irritable bladder, priapism, chordee, seminal emissions, incontinence of urine, and sexual erethism in its varied phases yield to lupulin, given in doses of 5 to 10 grains in syrup or jelly (larger doses of lupulin may cause colic and constipation).

External Uses. — Hops are useful externally as a sedative and soporific. For the relief of pain, the hop-bag—dipped into hot water, applied locally, and covered with rubber-cloth or oiled muslin—is a useful and efficient remedy. The hop-poultice may be made by mixing hops in with the flaxseed-poultice when ready to spread upon the cloth. Hops may be inclosed in a flannel bag and then dipped into hot whisky and applied locally for pain, as in toothache or earache; the hops seem to add a soothing effect to the warmth and moisture.

Lefferts advises the use of inhalations of the vapor of hops in diseases of the throat and chest. He directs that 20 grains of dried carbonate of soda be dissolved in a pint of warm water (140° F.), 1 drachm of extract (inspissated fluid extract) of hops be added, and the vapor inhaled.

The hop-pillow has been used in insomnia especially when associated with neurasthenia.

LUPUS. See Tuberculoses.

LYMPHADENITIS. See Adenitis.

M

MACE.—Mace (Macis, U. S. P.) is the arillode of the seed of *Myristica fragrans* (nutmeg), which is indigenous to the East Indies. Its active principle is a volatile oil, which closely resembles oil of nutmeg. Mace and its volatile oil are used principally for flavoring purposes, but occasionally as carminatives. Mace is given in doses from $^1/_2$ to 1 grain. The oil (non-official) may be given in doses of 1 to 3 drops on sugar.

Physiological Action. — The volatile oil, as shown by the experiments of H. C. Wood and Cadéac and Meunier, causes, when injected into the veins of lower animals, marked intoxication, characterized by tremors, loss of co-ordination, and gradually-increasing frequency of respiratory motions. In excessive doses there is narcosis; loss of reflexes and death from paralysis of the respiratory centres follows.

Therapeutics.—Mace is an aromatic stomachic and tonic, and in large doses a powerful narcotic. The oil is sometimes employed externally, as a rubefacient in paralysis and rheumatism. Poisonous doses cause a sensation of great thirst, a feeling of tightness in the chest, and induce vomiting. Coffee and stimulants are indicated when poisonous doses have been taken.

MAGNESIA.—Magnesium is a metal, light and having the appearance of silver, which, when rolled in thin plates or ribbons, can be ignited, and will burn with a brilliant, white flame, giving off a dense white smoke, which is the oxide, or magnesia. The metal is not used in

medicine. The oxide, magnesia, and some of its salts, carbonate, citrate, and sulphate are official.

Magnesia (light or calcined magnesia) occurs as a very light, white powder, having a slightly alkaline taste. It is soluble in dilute acids and in carbonic-acid water. It unites with water forming a hydrate. Dose, 5 to 60 grains.

Magnesia ponderosa (heavy magnesia) occurs as a dense, white, very fine powder. It does not form a hydrate as readily as the light oxide. Dose, 5 to 60 grains.

Magnesii carbonas, or light carbonate of magnesium, is prepared by precipitation, and occurs as perfectly white, light cubes, of a slightly-earthy taste and very friable, and is soluble in 3000 parts of water, and more freely in carbonic-acid water. Dose, 1 to 3 drachms.

Magnesii citras effervescens, or granulated effervescing citrate of magnesium, is a mixture of magnesium citrate, a sodium bicarbonate, citric acid, and sugar. It occurs as a deliquescent, coarsely-granular, white powder, without odor, having a mildly-acidulated, pleasant taste, and being soluble in 2 parts of water. Dose, $^1/_4$ to 1 ounce.

Liquor magnesii citratis is made from magnesium carbonate, citric acid, syrup of citric acid, and water; before dispensing, potassium bicarbonate is added, the bottle securely corked, and then well shaken. Dose, $^1/_4$ to 1 ounce.

Magnesii sulphas (Epsom or bitter salt or salts) occurs in small, colorless prisms or needles, without odor, but having a bitter, saline taste: it is soluble in $1\,^1/_2$ parts of water. Dose, $^1/_2$ to $1\,^1/_2$ ounces.

Magnesia and magnesium carbonate are alkaline; magnesium citrate and sulphate are neutral salts.

Ferri oxidum hydrastum cum magnesia. See IRON.

Pulvis rhei compositus. See RHUBARB.

Infusum sennæ compositum. See SENNA.

Physiological Action. — Administered alone, magnesium acts very slowly as a purgative, but, contrary to the effects obtained from sulphate of sodium, the purgative effect seems to increase when the same dose is repeated several days in succession. Again, while the former agent gives rise to no notable phenomena in the intestinal tract, magnesium, according to Trousseau and Pidoux, may induce an active inflammatory process, thus giving rise to the bloody atonic evacuations and the tenesmus occasionally noticed. Armaud Moreau observed that when a 15- to 20-per-cent. solution of magnesium was inclosed in an intestinal loop, between two ligatures, very active and localized secretion followed, the result of osmosis. The purgative action is also sustained, however, by the magnesium absorbed in the blood, though the salt thus absorbed is mainly eliminated by the kidneys. It can be found in the urine twenty-four or thirty-six hours after the purgative effects are produced.

To increase the rapidity of its action, citric acid is usually added to magnesium. A bicarbonate is thereby obtained which is actively cathartic.

> Saline purgatives have the power of exciting more or less the glands of the intestines and of causing them to pour forth their secretions abundantly. In moderate doses magnesium sulphate accomplishes this without appreciably stimulating the peristaltic action. This being the case, a part of the fluid poured out may be reabsorbed and carry with it into the blood a quantity of the salt, and also cause the contents of the bowel to lose their fluid or semisolid consistency. This seems to explain its action when given hypodermically and also to ex-

plain constipation after the drug has been given per rectum. In cases treated by the drug 2 or 3 grains of neutral magnesium sulphate injected into the deep muscular layers of the nates in men, or into the calf of the leg in women, were successful in 70 per cent. of the cases; 20 per cent. required more than one injection, and in 10 per cent. the bowels failed to act. In nearly all cases the bowels moved within ten hours after injection. James Wood (Ther. Gaz., Jan. 15, '95).

The preparations of magnesium are not free from toxic properties when taken in large doses.

Case of a woman, aged 30 years, in her usual health, who on retiring at night, took an ounce of Epsom salts. On the following morning she was found, in her room, dead. A careful post-mortem and chemical analysis yielded no evidence of any other cause of death. A. P. Luff (Brit. Med. Jour., Sept. 5, '91).

Case of a woman, about 35 years old, who took at a single dose 4 ounces of Epsom salts, dissolved in hot water. An hour later she had burning pains in the stomach and bowels; difficult respiration, attended by a choking feeling; and a peculiar weakness in the arms and legs. There was no vomiting or purging. Presently extreme collapse occurred; the pupils were dilated; there was slight twitching of the facial muscles; paralysis of the limbs was observed. The patient quickly became comatose, and death followed in an hour and fifteen minutes after the dose was swallowed. There was no autopsy. Lang (Lancet, Nov. 7, '91).

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Case in which patient took 1 ounce of Epsom salts. Only three slight motions resulted, and towards evening he began to feel very ill, and remained so through the night. The following day he was too ill to do anything. His illness continued, and he vomited frequently during the day. At 6 P.M. he was found lying on the bed in an attitude of flexion, perfectly indifferent to his surroundings, but answering questions intelligently when smartly roused. The face and hands were deeply cyanosed, the lips, eyelids, alæ nasi, and auricles being of a dark-purple color, while the conjunctivæ were intensely congested and the pupils dilated and unequal. The covered parts of the body presented a roseolous rash, and there was a zone of herpes zoster in the left submammary region extending around to the back. At this time the boy had several attacks of tetanic spasms, affecting the right side of the face and passing down the right arm, together with pronation of the hand. The tongue and teeth were covered with sordes, the stomach was enormously dilated, and urine was dribbling away. The right radial pulse was absent and the left hardly perceptible; the heart-beats were feeble and could not be counted. The extremities were cold; the axillary temperature was 105°.

He was given a dose of hot brandy and water, well-covered with blankets and packed with hot-water bottles. This was followed by a draught containing carbonate of ammonia, spirit of ether, and tincture of strophanthus. During the night he had frequent vomitings of a greenish fluid. The next morning the cyanosis was less marked, the radial pulses were perceptible, and he was better and more conscious of his surroundings.

As his bladder was greatly distended, he was catheterized and about 40 ounces of urine drawn off. By the end of the week he was practically well. J. H. Neale (Lancet, Aug. 15, '96).

Therapeutics.—ANTACID.—Magnesia, magnesia ponderosa, and magnesium carbonate are used as antacids. Of these, magnesia ponderosa would seem to be, perhaps, the best. Magnesia has the disadvantage of being bulky in sufficient dose, and magnesium carbonate is apt to give rise to flatulence on account of the carbonic-acid gas given off when it is subjected to the disintegrating action of the acid of the gastric juice. The latter objection, however, does not always hold, since the stimulating action of the carbonic-acid gas upon the mucous membrane of the stomach is often beneficial.

acting as a sedative and anodyne in the treatment of indigestion, sick headache, and pyrosis. In diarrhœa from indigestion, with acid stools, magnesia combined with rhubarb yields very satisfactory results.

Magnesia is free from taste, is non-irritating and antacid, and is, therefore, a very desirable remedy to administer to children. The carbonate combined with carminatives is especially useful in the flatulent colic and diarrhœa of young infants. Demers's formula is:—

℞ Carbonate of magnesia, $^1/_2$ drachm.
Tincture of asafœtidæ, 40 drops.
Laudanum, 20 drops.
Sugar, 1 drachm.
Distilled water, 1 ounce.—M.

The dose is $^1/_3$ to 1 teaspoonful, according to age.

Dalby's formula is similar:—

℞ Carbonate of magnesia, 40 grains.
Oil of peppermint, 1 drop.
Oil of nutmeg, 2 drops.
Oil of anise, 3 drops.
Tincture of castor, 30 drops.
Tincture of asafœtidæ, 15 drops.
Tincture of the oil of pennyroyal, 15 drops.
Compound tincture of cardamom., 30 drops.
Peppermint-water, 2 ounces.—M.

The dose is a teaspoonful as required.

Gout and lithiasis are benefited by the antacid magnesia preparations, but the potash- or lithia- salts are more efficient.

Antidote to Poisons.—The antacid properties of magnesia make it valuable as a antidote in cases of poisoning by the strong mineral or vegetable acids. It neutralizes the acids and acts as a mechanical protective to the tissues against the corrosive action of the acid-poisons. Its value as an antidote in poisoning by metallic salts depends upon the fact that it precipitates many metals from their acid of combination, and thus renders the metal less soluble and, therefore, less poisonous. In poisoning by arsenic, freshly-prepared hydrate of magnesia is an antidote of no mean value, but is not so effective as the official hydrate oxide of iron with magnesia, of which doses of 1 to 4 drachms are given.

Purgative.—Magnesia and carbonate of magnesia are often used as purgatives in children, as before mentioned. The neutral salts, the citrate and sulphate, are more generally used for this purpose. Magnesia and the carbonate are hardly suitable for continuous administration, as, being insoluble, they may accumulate in the intestines and form concretions consisting of the hydrate of magnesia. The citrate and sulphate of magnesia cause little, if any, irritation, and are on that account valuable as laxatives in enteritis and peritonitis. In febrile affections, given in small doses, they exert a refrigerant and slight diuretic action. Combined with iron, they are useful in constipation associated with atonic conditions. In anæmia and chlorosis, which Clarke attributes to fæcal intoxication, the "mistura ferro-salina" is a useful tonic laxative.

℞ Sulphate of magnesia, 1 ounce.
Cream of tartar, 1 drachm.
Dried sulphate of iron, 10 grains.
Water, 2 pints.—M.

Of this a wineglassful should be taken a half-hour before breakfast each morning.

The constipation of lead poisoning is relieved best by magnesium sulphate as follows:—

℞ Magnesium sulphate, 2 drachms.
Morphine sulphate, 1 grain.
Peppermint-water, 3 ounces.

Mix and give a tablespoonful every two hours in lead colic.

The purgative mineral waters (Friedrichshall, Pullna, Sedlitz, and Hunyadi waters) owe their purgative action principally to the presence of magnesium sulphate.

Serous Effusions. — Magnesium sulphate given in doses of 1 or 2 ounces daily, in as little water as will dissolve the salt, will yield good results in serous effusions (pleural, peritoneal, etc.), especially if the amount of fluids ingested be restricted. It may be given by enema if preferred, as proposed by Watkins:—

℞ Magnesium sulphate, 2 ounces.
Glycerin, 1 ounce.
Water, 4 ounces.

Œdema and Anasarca. — Œdema and anasarca are relieved in a similar manner by magnesium sulphate. It relieves the congestion of the kidneys in general anasarca. It is also of value in œdema of the lungs and brain, in Bright's disease, and ascites. In uræmia associated with constipation, magnesium sulphate is a valuable remedy.

Diarrhœa and Dysentery.—Diarrhœa from fæcal impaction is best relieved by small doses of magnesium sulphate every hour. It is also useful in dysentery combined with aromatic sulphuric acid and laudanum. In acute dysentery it will often remove the fever, the blood and mucus from the stools, and the tenesmus. Leahy advises the use of the following: Saturate 7 fluidounces of water with a sufficient quantity of magnesium sulphate, and add 1 ounce of diluted sulphuric acid. Of this give a tablespoonful every hour or two in a wineglassful of water until it operates. Morphine may be added, or starch enemata with laudanum may be used.

In summer diarrhœa magnesium sulphate is strongly advocated. From 1 teaspoonful to a tablespoonful of the salt, according to the age, moistened sufficiently to be swallowed, may be given daily until the discharges become yellow. Koplik (Jour. Amer. Med. Assoc., Oct. 12, '95).

Rectal Disorders.—Magnesium sulphate is an agent of great value in rectal disorders, as it liquefies the fæcal passages and renders them less irritating. In cancer or stricture of the rectum and fissure of the anus this is very desirable. This and other salines will act painlessly upon the bowels of a patient fully under the influence of opium, which renders them especially useful in atony of the rectum.

The unpleasant taste of magnesium sulphate may be disguised by a small amount of the fluid extract of licorice or by boiling it with or giving it in coffee. For general use 4 ounces of magnesium sulphate may be dissolved in 4 ounces of lemon or other syrup, and enough water added to make one pint. Of this the dose is a wineglassful or two.

External Uses. — Magnesium and the carbonate are used as a toilet powder, to dry the skin, to prevent chapping and excoriation in intertrigo, and to relieve the irritation due to sunburn and that left after shaving. This is applied also as a cosmetic to relieve the shining appearance and gloss of the facial integument, the cubes of magnesium carbonate being generally preferred for this purpose.

C. Sumner Witherstine.

Philadelphia.

MALARIAL FEVERS.

Definition.—Under the name malaria is included that group of diseases due to infection with the animal parasite de-

scribed by Laveran and now known as the hæmatozoön malariæ, or, less appropriately, plasmodium malariæ.

The term malaria was originally applied to these diseases to designate the conditions then most evident in their production, having its derivation from the Italian *mal'aria*, the English equivalent of which is "bad air." While this is in no wise descriptive of the disease, either clinically or pathologically, the name has obtained such wide usage that its continued employment is fully justified.

The protozoön discovered by Laveran is to be regarded as always present in malaria, and in accordance with the variety, or species, of the parasite present its effects are manifested as quartan and tertian fever, which are the regularly intermittent forms of the disease, and as æstivo-autumnal fever, which includes the irregularly intermittent and remittent forms, as well as the pernicious varieties and chronic malarial cachexia.

Synonyms.—Malarial fever is known by many synonyms, which are frequently derived from the localities in which it prevails; as, Roman fever, Chagres fever, Panama fever, African fever, jungle fever, lake fever, coast fever; also, paludism, paludal fever, autumnal fever, marsh fever, swamp fever, marsh miasm or miasmatic fever, fever and ague, and chills and fever. In accordance with the intensity of particular symptoms the disease may be known as intermittent fever, remittent fever, congestive fever, blackwater fever, hæmorrhagic malarial fever, and bilious remittent fever.

The Malarial Parasite and Mechanism of Infection.

The malarial parasite is a unicellular organism belonging to the class of protozoa, and first discovered and described by the French military surgeon Laveran in 1880. Since the publication of Laveran's discovery his observations have been confirmed and enlarged upon by many observers in all parts of the world, and, while there is still but little known of the life of the organism outside the human body, its causative relation to malarial fever has been conclusively demonstrated. Laveran's work was first confirmed by Richard, in Algiers, in 1882, and later by Marchiafava and Celli, the results of whose observations were derived from the study of dried malarial blood subjected to staining. In 1885-86 our knowledge of the subject was greatly advanced by Golgi, who proved the relation existing between the different stages of the malarial paroxysm and the cycle of development of the parasite. The same observer first recognized two special varieties of the parasite as belonging each to quartan and tertian fever, while still later, in 1889, Marchiafava and Celli recognized particular forms associated with æstivo-autumnal fever. In America the investigations of Councilman, Sternberg, Osler, Dock, and Thayer and Hewetson have added much to our knowledge of the subject.

It will thus be seen that at least three varieties of malarial parasites are to be considered, each of which passes through a cycle of development which in its general characteristics is common to all. In accordance with the variety of parasite the cycle of development varies in duration from twenty-four to seventy-two hours. Development begins in the form of small, hyaline bodies within the red blood-cells, possessing the power of amœboid movement, and without color. Increase in the size of these bodies takes place and coincidently there is to be observed within them, near the periphery of the parasite, a collection of pigment-granules. These granules increase in

PLATE I.

The Malarial Parasite (Mannaberg.)

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amount with the further development of the parasite, and are frequently observed to be in active motion.

With the attainment of maturity the parasite gradually becomes quiescent, and completely or only partly fills the red blood-cell, as the description may apply to one or the other variety of parasite. Changes in the corpuscular host of the parasite, affecting chiefly its shape and color, occur coincidently with the various stages of parasitic development.

The parasite having reached its full development, the pigment-granules within it begin to clump, usually near the centre, and the stage of segmentation commences. When completed, the process divides the parasite into a number of oval bodies or spores, while the corpuscle which has acted as host bursts and the subdivisions of the parasite, or spores, are set free, the pigment-granules remaining behind to float free in the blood-serum or to be taken care of by the process of phagocytosis. The spores thus set free very soon enter fresh corpuscles and there begin the cycle of development anew.

In accordance with the observations of Golgi and of Marchiafava and Celli, confirmed by many others, three varieties of parasites may be differentiated: (1) the parasite of quartan fever, (2) the parasite of tertian fever, and (3) the parasite of æstivo-autumnal fever.

Colored Plate I.—*Parasites of the First Group.*—Fig. A. 1-22. Phases of development of the quartan parasite. 23. Rare form of sporulation. Fig. B. Plan of the sporulation of the quartan parasite according to Golgi. Fig. C. Melaniferous leucocytes. Fig. D. Vacuoles of red corpuscles undergoing changes in shape.

1. The *quartan parasite* attains its full development in seventy-two hours and shows more regularity in its evolution than any other variety. Unlike the tertian and æstivo-autumnal varieties, it completes its development, not in the viscera and bone-marrow, but entirely in the circulating blood.

The young parasite is small, about one-fifth to one-fourth the size of the red blood-cell, and exhibits amœboid movements that are sluggish when compared with the movements of the tertian parasite. As the parasite grows, occupying eventually a little more than one-half to two-thirds of the corpuscle, pigment-granules appear within it. This pigment is coarse and dark, as compared with the pigment within the tertian parasite, and does not present the active motion to be observed in the pigment-granules of the latter variety. The corpuscle surrounding the parasite often becomes deeper in color and frequently assumes a coppery hue, while at the same time it may become a little smaller and somewhat shriveled. In the full development of the parasite the corpuscle is frequently observed as a thin layer surrounding the parasite, which now presents the evidences of segmentation and the massing of pigment-granules. This, however, does not always take place in the centre of the parasite, but frequently toward the periphery, and not uncommonly shows a striated arrangement. This distribution of the pigment in striæ extending from the periphery to the centre divides the organism into segments, from six to twelve in number, in which can be observed the spores, and thus produces the rosette forms described by Golgi. The completion of segmentation results in setting free the spores which, as young hyaline bodies, invade other corpuscles and begin a new cycle of existence.

At times, infection by more than one group of quartan parasites occurs, resulting, if the infection be with two groups,

in double quartan, if with three groups in triple quartan fever.

Although, as stated, the quartan parasite is more regular in its development than the other varieties, deviations in certain instances from the description just given may be noted. The mature parasite, instead of sporulating, may, in the quartan variety as well as any variety, develop into the flagellate form: while certain other parasites, failing of sporulation, after escaping from the corpuscles become much swelled and present irregularities of outline, eventually breaking up into a number of irregular forms, or becoming vacuolated in their entirety.

COLORED PLATE II.—*Parasites of the First Group.*—Fig. A. 1-22. Phases of development of the ordinary tertian parasite (17 and 18, according to Thayer and Hewetson). 23-29. Hydropic, degenerated, disintegrated bodies. Fig. B. Plan of sporulation of the tertian parasite according to Golgi.

2. The *tertian parasite* requires forty-eight hours to complete its cycle of development. Although this parasite is to be found in the circulating blood during certain stages of its development, sporulation takes place chiefly in the spleen and bone-marrow, and in this particular differs from the quartan organism. The young tertian parasite appears in the red blood-corpuscles as a small, pale body, 1 to 2 microns in diameter, possessing active amœboid motion. Not only are the movements more active than with the quartan parasite, but from the periphery of the tertian parasite long, branching prolongations, or pseudopodia, are sent out and which very soon are again withdrawn, to be followed by another change in the shape of the organism. This stage of development may last for twenty-four hours, and then the parasite begins to collect pigment-granules and rods, which are finer and of lighter color than in the quartan parasite, and tend to collect particularly around the periphery of the organism. The movement of the pigment-granules is very active. As the parasite develops, the accumulation of pigment increases and the amœboid movements lessen. Nevertheless these movements do not cease altogether, for even during the period of the paroxysm marked by apyrexia pigmented parasites may be observed to undergo strange alterations in form by the sending out of pseudopodia, although by this time more than half of the red blood-corpuscle serving as host may have been occupied. (Mannaberg.) The red blood-corpuscles infected with the tertian parasite undergo decided changes, becoming distinctly swelled, and, when compared with the uninfected corpuscles, are observed to be much paler than normal. At times, however, the red blood-corpuscles may not increase in size, but may actually shrink and present a brassy or greenish tint.

After the lapse of about forty-eight hours sporulation occurs, having been preceded by the complete quiescence of the parasite and the aggregation of the pigment-granules into a mass near its centre. Just prior to segmentation the parasite attains about the size of the normal red blood-corpuscle, while the swelled corpuscle containing it becomes pale in color.

Segmentation occurs by the splitting up of the parasite into 15 or 20 divisions, or segments, which are not arranged with the regularity characterizing the quartan parasite. The larger number of spores contrasted with the smaller number resulting from segmentation of the quartan parasite constitutes an important factor in the differentiation of the two varieties of parasites. The spores of the tertian parasite are round and smaller

PLATE II.

The Malarial Parasite (Mannaberg)

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than those of the quartan parasite, and a refractive dotlet, the nucleolus, which is less defined than in the quartan spores, can usually be observed.

The spores having been set free, fresh blood-corpuscles are entered, and as young parasites the cycle of development is again gone through.

The act of sporulation in tertian, as in quartan, infection corresponds with the occurrence of the paroxysm, and several hours before this event individual spores may be detected in the blood; they are to be found, however, in greatest number at the time of the occurrence of the chill or during the beginning of the hot stage of the paroxysm.

In tertian infection not all the parasites pass through their cycle of development in a typical manner, and the occurrence of flagellate bodies and other degenerated forms, such as vacuolation, fragmentation, etc., is far more common than in the quartan variety.

Infection with two groups of tertian parasites may occur, passing through their cycle of development and attaining maturity upon successive days. This is of more common occurrence than infection with a single group, and results in the production of a fever of quotidian type.

Anticipating and postponing fevers of the tertian variety are to be explained by the tendency to the lack of regularity in the time necessary for the completion of its cycle of evolution: thus, the time required may be shorter or longer than forty-eight hours.

3. The *æstivo-autumnal parasite*, or *Hæmatozoön falciparum* of Welch, presents peculiar difficulties in study for the reason that its cycle of development is completed mainly within the internal organs. Its development is accompanied with more irregularity than that which attends the other varieties of parasites, and, while clinically it may be possible in the milder instances of infection to recognize certain types, such as quotidian and tertian, the type is so confused as to render its analysis almost impossible. Recent investigations have not succeeded in satisfactorily proving that these clinical variations depend upon infection with special varieties of æstivo-autumnal parasites completing their cycles of development upon different days, and the majority of observers have been unable to accept the division of the æstivo-autumnal parasite into a quotidian and tertian variety as urged by Marchiafava and Bignami.

> [In this connection Thayer and Hewetson ("Amer. System of Prac. Med.," "Malaria," Welch and Thayer, vol. i. p. 39) say: "We have been unable to trace a constant length of the cycle of development, and we have been unable further to separate two or more types of the (æstivo-autumnal) parasite depending either upon the length of the cycle of development or upon any other morphological or biological differences. We believe that the length of the cycle varies greatly in different cases, lasting usually from twenty-four hours, or even a little less, to forty-eight hours or more. After the infection is five days or a week old certain of the organisms, instead of segmenting, pursue a further growth, developing into the hyaline, refractive, ovoid, and crescentic bodies."
>
> The contrary view, in favor of the division, made by Marchiafava and Bignami, is held by Mannaberg (Mannaberg, 1899: Nothnagel's Spec. Path. u. Ther., B. 2, T. 2, S. 68), who not only concurs in the division of the æstivo-autumnal parasite into quotidian and tertian, but further subdivides the former into the pigmented quotidian parasite and the unpigmented quotidian parasite. JAMES C. WILSON and THOMAS G. ASHTON.]

The æstivo-autumnal parasite possesses the distinctive characteristic of producing crescent-shaped bodies: hence Welch

has proposed for it the name of *Hæmatozoön falciparum*. These bodies are not usually found in the blood until a case of æstivo-autumnal fever has lasted for a week or more. Their development is now regarded as intracorpuscular, and in the early stages of their evolution they are infrequently met with in the circulating blood. In the spleen and bone-marrow, however, particularly the latter, they are to be found in abundance. They are to be regarded as *transformed* from the intracorpuscular spherical organisms, and do not belong to the cycle of development as regularly performed by the parasite. Instead of being crescentic, these bodies may be oval or fusiform in outline, and, of whatever form, are always pigmented.

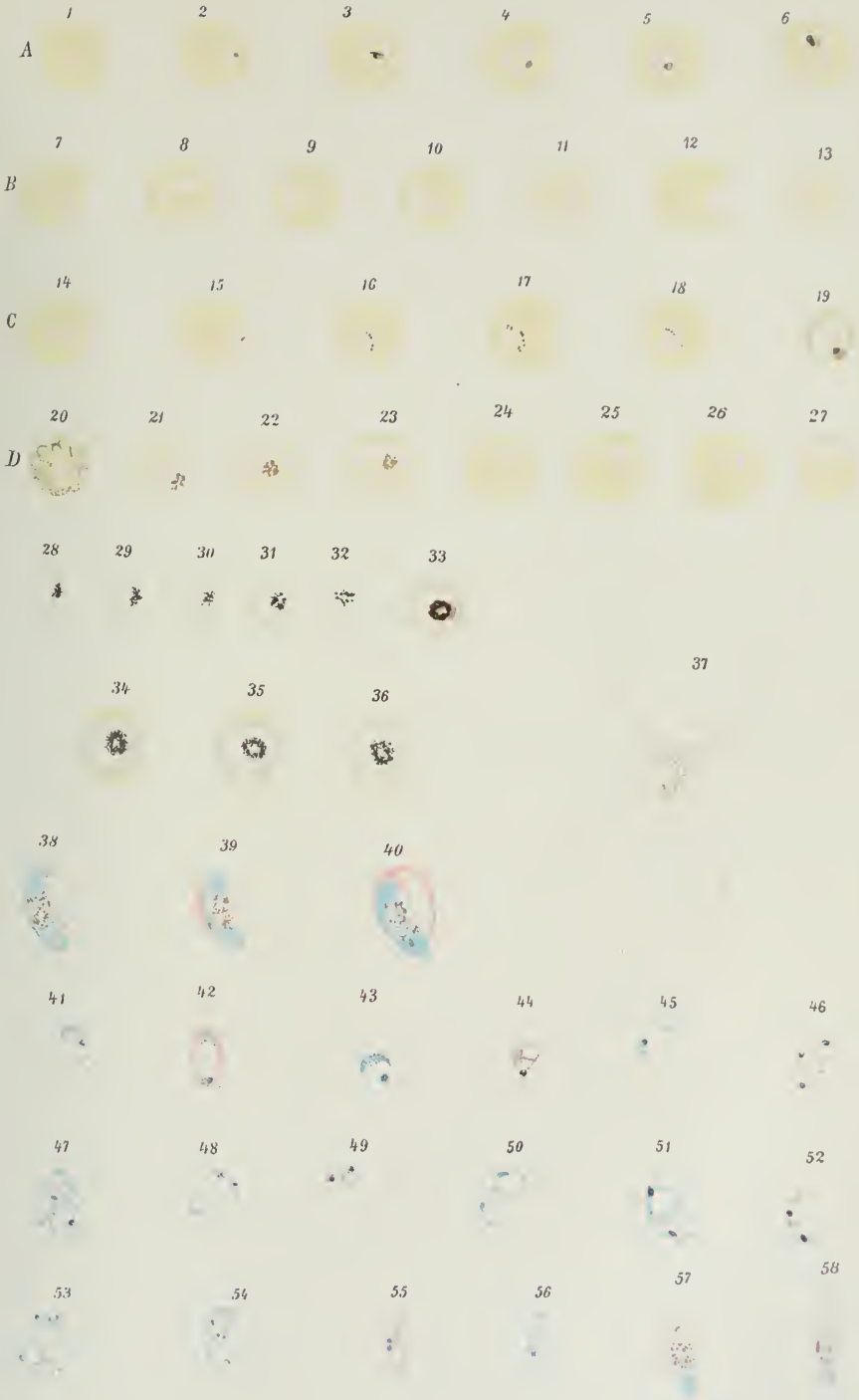
The young hyaline body of the æstivo-autumnal parasite is the smallest of the malarial parasites, and, while in its earliest stages it may not show much activity, in the course of its development it presents marked amœboid movements. It is to be observed in the red blood-corpuscle during or shortly after the paroxysm, and is about one-sixth the diameter of its host. The young parasite is distinct, and stands out in contrast to the surrounding structure of the blood-corpuscle. This clear, hyaline ring is usually thicker at one portion of its circumference, and presents one or more central or eccentric shaded dots, through which may be seen the color of the red blood-corpuscle; these spots are supposed by some to be nuclei.

With the development of the parasite amœboid movements become active and are frequently attended with the throwing out of pseudopodia. Pigment-granules, at first very fine and dark brown in color, soon begin to appear toward the periphery of the parasite. These granules later increase in size and number; but it is distinctive of the æstivo-autumnal parasite that they are fine and relatively few in number and possess but little motion. With the approach of the paroxysm the parasite becomes quiescent and the pigment-granules collect at or near its centre. The parasite next enters upon the stage of sporulation, which is characterized by much greater irregularity than the corresponding stage in the evolution of the other varieties of malarial parasites. The number of spores is variable and may range from six to twenty or more.

The corpuscle enveloping the parasite may not show any change in appearance. Very frequently, however, it becomes shrunken and deformed and assumes a brassy color, with retraction of the hæmoglobin away from the periphery and its distribution around the parasite. The fully-developed parasite in the presegmenting stage is smaller than the quartan and tertian parasites at a similar period of their evolution, and, as a rule, is not more than one-fourth or one-third the size of the red blood-corpuscle.

Fever of a quotidian or tertian type may result from æstivo-autumnal infection, and this association is to be ascribed to variations in the length of the cycle of development of the parasite rather than to infection with supposed special varieties. As previously observed, however, Marchiafava and Bignami, Mannaberg, and others subdivide the parasite into quotidian and malignant tertian varieties, the latter in contradistinction to the tertian parasite of the regular variety described by Golgi. Further, not all of the æstivo-autumnal parasites develop pigment-granules, and cases occur in which no pigmented bodies are to be observed at any stage. This fact has led to the further subdivision of the so-called quotidian æstivo-autumnal para-

PLATE III



The Malarial Parasite (Mannaberg)

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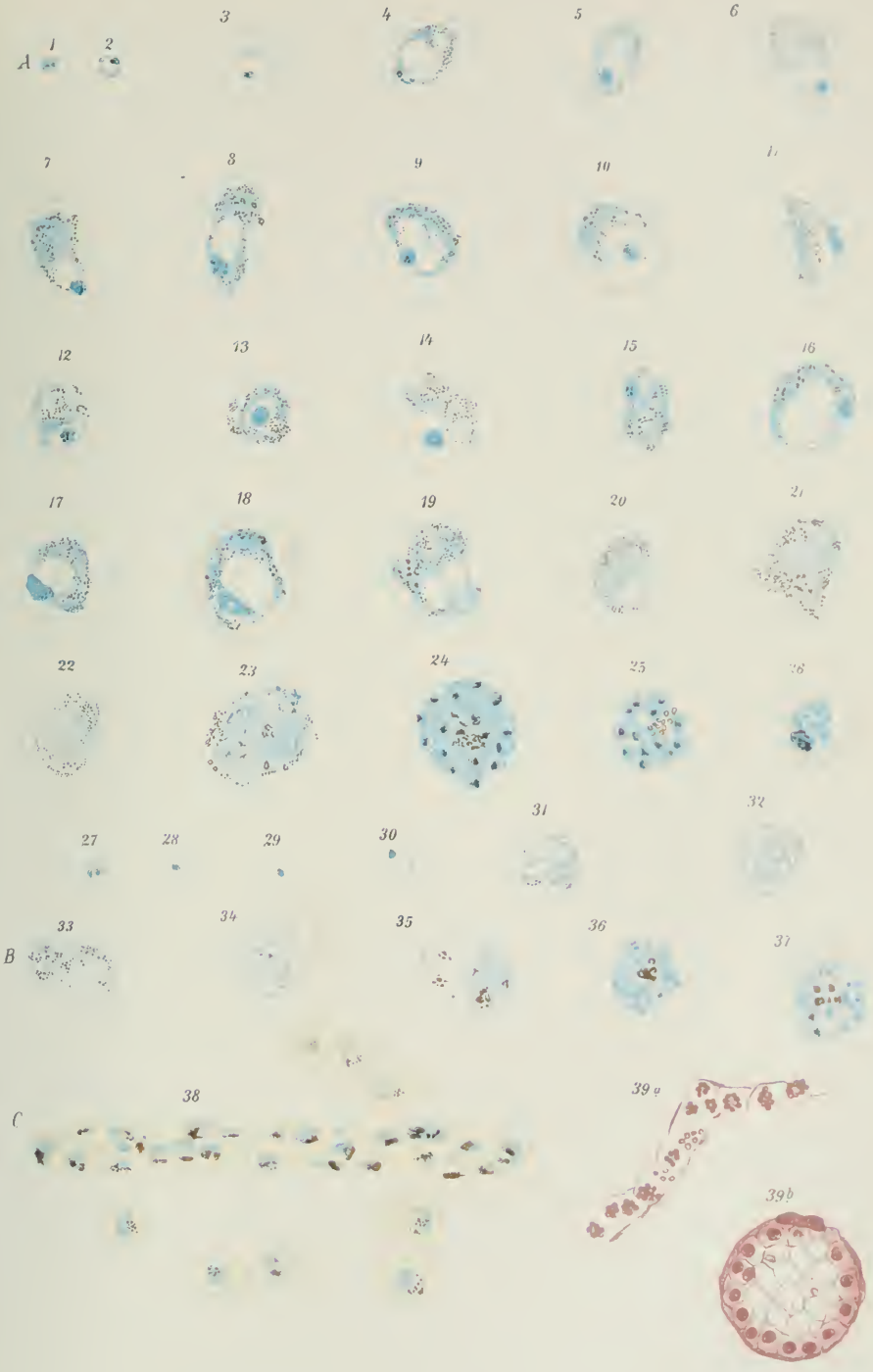
PLATE IV



The Malarial Parasite (Mannaberg)

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site into pigmented and unpigmented forms (Grassi and Feletti, Mannaberg). The following description is given by Mannaberg as distinctive of these varieties:—

Colored Plate III.—*Parasites of the Second Group.*—Fig. A. 1-6. Pigmented quotidian parasites. Fig. B. 7-13. Unpigmented quotidian parasites. Fig. C. 14-19. Malignant tertian parasites. Fig. D. 20. Corpuscle showing brassy discoloration. 21-37. Bodies of the crescentic series. 24-26. Coalescence of two amœboid parasites (copulation). 27. Syzygy. 38-40. Stained crescentic forms (Romanowsky's method). 41-58. Stained parasites of the second group. 49-57. Showing the origin of the crescentic bodies: syzygies (staining with hæmatoxylin after picric-acid fixation).

The *pigmented quotidian* parasite completes its development in twenty-four hours; it begins its existence, as do the other forms, as a very small body without pigment. It is pale and forms but little contrast with its containing blood-corpuscle; so that it would readily be overlooked were it not for the active amœmoid movements it possesses. When at rest, however, it appears as a small distinct ring of pale color and with a reddish centre, the latter appearance being probably due to the thinning of the parasite at that point, permitting the color of the red blood-corpuscle to be seen through it. The young parasite contains very fine pigment-granules, which often are quite red and which are to be seen occupying its periphery. When the parasite has attained to the size of about one-third of the blood-corpuscle, the pigment collects in the middle or in that portion of the border where amœboid movements have ceased. Following the massing of the pigment in this manner into a dark, quiescent clump the parasite breaks up into a limited number of very small spores. Occasionally the organism attains a considerable size and at the time of its sporulation may occupy almost the entire blood-corpuscle. It frequently happens, however, that the corpuscle becomes shrunken and assumes a brassy hue. After the infection has continued for a number of days crescents are to be observed; these may be the ordinary crescentic-shaped bodies, the fusiform bodies with pointed extremities, or the spherical bodies of this group.

The Unpigmented Quotidian Parasite.—The occurrence of a malarial parasite that completes its cycle of existence, even to sporulation, without accumulating pigment has been described by Marchiafava and Celli, whose observations have been confirmed by others. Except for the absence of pigment, this parasite resembles the pigmented quotidian parasite so closely that the same description may answer for both. In the early stage of its existence it possesses the same amœboid movements and completes its cycle of development in about the same time, or, perhaps, somewhat sooner. As in all æstivo-autumnal varieties, sporulation is carried on almost entirely in the internal organs. From this form of parasite, also, crescents develop which, of course, contain pigment: a characteristic common to all members of the crescentic group.

Colored Plate IV.—Fig. A. 1-32. Ordinary tertian parasite, showing staining of its structure according to the method of Mannaberg (picric acid, hæmatoxylin). Fig. B. Showing changes produced by the administration of quinine. Fig. C. 38. Cerebral capillary with pigmented parasites of the second group (from a preparation by Professor Celli). 39. Cerebral capillaries with unpigmented sporulating parasites of the second group (from a preparation by Professor Celli).

The Malignant Tertian Parasite.—This variety of parasite was separated from the other forms by Marchiafava and Bignami. In its morphological char-

acteristics it resembles very closely the pigmented quotidian parasite from which in many stages of its development it is with difficulty differentiated. Marchiafava and Bignami claim for it the following points of dissimilarity: 1. Its cycle of development continues forty-eight hours. 2. The pigment sometimes shows oscillatory movements, which do not occur in the quotidian parasite. 3. The parasite attains a considerable size and at the time of sporulation occupies one-half or two-thirds of the blood-corpuscle. 4. In the advanced stages of pigmentation active amœboid movements are still to be seen. 5. The unpigmented stage lasts over twenty-four hours.

From the ordinary tertian parasite the malignant tertian parasite differs in the following particulars: 1. In all stages the malignant tertian parasite is smaller. 2. It often assumes the distinct ring-shape which the ordinary tertian parasite lacks. 3. Pigment-granules are not so numerous and only exceptionally show motion. 4. The infected blood-corpuscles show a tendency to shrink, while in the ordinary tertian infection they swell up. 5. The spores are smaller and not so numerous. 6. The pernicious tertian parasite develops crescents.

Degenerate forms of the æstivo-autumnal parasite, hydropic, fragmented, flagellate, or vacuolated, occur as in the other forms of malarial infection. These are derived from those parasites that fail to properly mature and undergo segmentation, particularly the extracorpuscular bodies which in this variety of infection are common.

Infection with two or more groups of æstivo-autumnal parasites, each in a different stage of development, is of common occurrence, and a combined infection with one of the other varieties, especially the tertian, is occasionally seen.

The development of *crescentic*, ovoid, or fusiform bodies and the significance of their association with æstivo-autumnal infections have already been referred to. These bodies are not likely to be observed in the blood until the fever has lasted for a week or more; they may persist, however, for several weeks after other forms of the parasite have disappeared. The intracorpuscular origin of crescents has been proved by Marchiafava and Celli and confirmed by many others, and, as stated, they result from the transformation of intracorpuscular spherical forms of æstivo-autumnal parasites, which at this point fail to continue their orderly cycle of development. Except rarely, only fully-developed crescents are observed in the circulating blood, the early stages of intracorpuscular development taking place in the spleen and, especially, the bone-marrow. They are always pigmented, and the pigment, which is very dark in color and usually in fine rods or granules, is without movement and is collected in one or two masses near the middle of the organism. In crescents that are not fully developed the pigment is less regularly disposed. From crescents flagellate bodies may develop, but only from the round bodies of the group.

[According to the view entertained by Mannaberg, crescents are to be regarded as encysted syzygies produced by the conjugation of two parasites (æstivo-autumnal) and therefore capable of segmentation and reproduction. This, however, is not the generally-accepted hypothesis regarding the significance of these bodies. The majority of observers hold to the view that, in the human body at least, they exist as sterile forms, and, if they possess any reproductive faculty, require for its accomplishment some favorable extracorpuscular environment. Bignami and Bastianelli (Lancet, Dec. 17, '98), in their latest contribution to this subject, arrive at these conclusions: "We

have, indeed, favored the idea that the semilunar bodies are sterile on the grounds that one never sees in them any form of multiplication and that they have no relation to relapses; and these assertions, even in the light of these new observations, we still hold by as in accordance with the truth. In other words, we contended that crescents are sterile bodies *in man* and *as far as man is concerned.* In fact, we put forward the additional hypothesis that these bodies represent those phases of the life of the malarial parasite which in other parasites are continued and completed outside of the host. Should such migration from the host fail to occur, then that phase of life which cannot be completed except in the outside world or in a new host will be carried out in an abortive way and will terminate in forms of degeneration.

"Certainly these new researches render probable the hypothesis that the cycle commenced in the blood of man is completed in some species of mosquito, but they nevertheless do not negate the truth of the fact alluded to in our first hypothesis in those cases where the passage from man to the new host fails to take place." JAMES C. WILSON and THOMAS G. ASHTON.]

Flagellation is an occurrence common to each of the three principal varieties of parasites. It is to be observed within eight to twenty minutes after the blood has been withdrawn from the body and does not occur in the circulating blood. As already pointed out, in æstivo-autumnal infection flagellate bodies develop only from the spherical form of the crescentic group, while in tertian and quartan infections their origin is from the full-grown extracorpuscular organisms. The length of the flagella varies from one-half the diameter of a red blood-corpuscle to an extent three or four times longer. Their number may vary from one to six and their attachment may be to any portion of the circumference of the body. Free, detached flagella may also be observed. As may be surmised, the active movements of the flagella produce a marked disturbance of the blood-corpuscles.

According to Manson, flagella constitute the first phases of the malarial parasite outside of man, and they represent parasites in sporulation the spores of which take on this special form of mobile and flagellated filaments "in the interest of the extracorporeal life of the plasmodium." Much the same view is entertained by Mannaberg, who believes that they represent a phase of the saprophytic existence of the parasite. Regarding their internal structure we possess no knowledge other than that imparted by Sacharoff, who considers the flagella as chromosomes originating in the nuclei of the body of the parasite, while the flagellation he regards as a process of perverted karyokinetic division accomplished in a violent manner.

Literature of '96-'97-'98.

Frequently in slides of the blood of infected crows there appear, after standing from twenty to thirty minutes, elongated motile forms such as were described by Danilewsky as vermiculi in his "Parasitologie Comparée du Sang"; and in order to trace their origin it is necessary to observe closely the changes in the other forms seen in the blood. Only the mature forms of the organism are seen to undergo any changes in the fresh slide of blood, the half-grown and younger forms remaining unchanged for a long time. The mature forms become rounded off, and are extruded from the corpuscle, which remains as a shadow in the plasma.

Both in the fresh and in the stained specimens of blood there can be seen differences which sharply distinguish two forms of the organisms. The forms are identical in outline, but the protoplasm of one is granular and opaque as compared with the clear hyaline protoplasm of the other. This distinction is well

brought out in the stained specimen, in which the hyaline form remains almost entirely unstained, while the other takes on a well-marked blue stain with methylene-blue. Of these it can be determined that the hyaline forms alone become flagellated.

These two forms, then, become extruded alike from the corpuscle and lie free in the plasma, but generally only a very short time elapses before the hyaline forms become flagellated, according to the process so often and so accurately described by workers on malaria. The granular forms lie quiet beside the nuclei and shadows of the red blood-corpuscles that lately contained them, but are soon seen to be approached by the flagella, which, having torn themselves away from the hyaline organism from whose protoplasm they were formed, struggle about among the corpuscles. These flagella, which so concentrate their protoplasm as to form a head, swarm about the granular spheres, and one of them plunges its head into the sphere and finally wriggles its whole body into that organism. Immediately on the entrance of this flagellum it seems to become impossible that another should enter, for they may be watched circling about, vainly beating their heads against the organism. The flagellum which has entered continues its activity for a few moments and the pigment of the organism is violently churned up. Soon it becomes quiet again, and remains so for from fifteen to twenty minutes, when a conical process begins to appear at one side of the organism, the pigment collecting mainly to the opposite side. This process grows larger and the pigment becomes more and more condensed, until finally we have a fusiform organism with a small spherical appendage crowded with pigment at one end. The other end is hyaline, and the pigment-granules which are not crowded into the small appendage are distributed superficially over the posterior part of the body. This spindle-shaped organism moves forward with a gliding motion, sometimes turning at the same time on its long axis, sometimes going through amœboid contortions. Red corpuscles lying in its path are either punctured by the hyaline anterior end, so that the hæmoglobin is enabled to escape into the plasma, or passed over and dragged along by the adhering posterior extremity.

In an intense infection a great destruction of corpuscles occurs; thus in a fresh slide after standing some time even leucocytes may fall victims to the destructive force of these organisms, which have been seen to dash through them, scattering the granules into the plasma. As to the ultimate fate and true significance of these forms nothing definite can as yet be stated. In the slide they keep in motion for a long time, but finally quiet down and disintegrate. The idea suggests itself from their great power of penetration that they may be the resistant forms that escape from the body during life into the external world. The whole process described above seems to be a sexual process analogous to the sexual process seen in the lower animals and plants which occurs under unfavorable conditions and results in the formation of a resistant "spore."

Recently blood of a woman suffering from an infection with the æstivo-autumnal type of organism in which a great number of crescents were to be seen. These, in the freshly-made slide of blood, with very few exceptions, retained their crescentic shape for only a few minutes (this activity in the change of form varies greatly in specimens of blood from different patients). They soon drew themselves up, thus straightening out the curves of the crescent, while shortening themselves into the well-known ovoid form. After the lapse of from ten to twenty minutes most of them were quite round and extracorpuscular, the "bib" lying beside them as a delicate circle or "shadow of the red corpuscle." After from twenty to twenty-five minutes certain of the spherical forms became flagellated; others, and especially those in which the pigment formed a definite ring and was not diffused throughout the organisms, remaining quiet and did not become flagellated. The flagella broke from the flagellated forms and struggled about among the corpuscles, finally approaching the quiet spherical forms. One

of them entered, agitating the pigment greatly, sometimes spinning the ring about; the remainder were unable to enter, but swarmed about, beating their heads against the wall of the organism. This occurred after from thirty-five to forty-five minutes. After the entrance of the flagellum the organism again became quiet and rather swelled; but, although in the two instances in which this process was traced the fertilized form was watched for a long time, no form analogous to the vermiculus was seen. MacCallum (Lancet, Nov. 13, '97).

Phagocytosis. — The destruction of the malarial organism is effected partly by the process of phagocytosis and partly by the germicidal properties of the blood-plasma, but the relative importance played by each is not, as yet, entirely clear. That the blood-plasma may possess this effect is well demonstrated by the destruction of the young spores after the exhibition of quinine. The cells chiefly concerned in phagocytosis are the large mononuclear and polymorphonuclear leucocytes and cells derived from the spleen, liver, and bone-marrow, termed macrophages, as well as from the endothelium of the blood-vessel walls. The process is to be best observed by the microscopical examination of the organs after death, although during life it may be satisfactorily studied in blood withdrawn from the spleen and, to a limited extent, in the peripheral blood. The phagocytes may attack the organism while it is contained within the red blood-corpuscle and envelop both host and parasite. The flagellate bodies appear to be objects of particular attack, together with extracorpuscular and various other degenerated forms. As just intimated, however, to the blood-plasma is to be ascribed an important part in the destruction of the parasites. This is confirmed by the fact that the greatest destruction of the parasites occurs at the time of sporulation, when the young organism is set free in the plasma, and by the further fact that it is at this period of the cycle of development that quinine exercises its greatest influence. We may conclude, therefore, that the destruction of the parasite is affected by the combined action of the blood-plasma and the phagocytes.

Literature of '96-'97-'98.

The lymphocytes are never phagocytic in malaria. Those holding the opposite view have been misled by the fact that normally there exists a lymphocytic pigmentation which is, therefore, a physiological not a pathological condition. Patrick Manson (Brit. Med. Jour., Sept. 24, '98).

Manner of Infection. — Since the discovery of the malarial parasite much work has been done looking to a solution of the problem of the manner in which infection of the body takes place and the channels through which the organism enters. This is one of the most important of the, as yet, unsolved problems relating to malaria, and until its solution is attained an effective prophylaxis cannot be hoped for.

It is agreed that infection may possibly take place by the entrance of the parasite through:—

1. The digestive tract (the water-theory).

2. The respiratory tract (the air-theory).

3. The skin (the inoculation-theory).

1. Although many believe that malaria may be conveyed into the system through the digestive tract by means of infected water, the weight of evidence is overwhelmingly against the probability that infection occurs by this channel. To prove it the experiment, to be conclusive, must be made upon a person who has had no previous exposure to malaria

and who at the time must be removed from any other possible malarial influences, and after the administration of the supposedly-infected water the blood must be properly examined for the presence of the parasite.

[Celli (quoted by Mannaberg: Nothnagel's Spec. Path. u. Ther., B. 2, T. 2, S. 94), in the Hospital of S. Spirito, Rome, caused several persons to drink water derived from the pontine marshes and from the marshes in the regions surrounding Rome, for a number of days, and none of them developed malaria. Brancaleone (quoted by Mannaberg: Nothnagel's Spec. Path. u. Ther., B. 2, T. 2, S. 94) pursued the same experiment in Sicily with the same negative result. Zeri (quoted by Mannaberg: Nothnagel's Spec. Path. u. Ther., B. 2, T. 2, S. 94) caused nine persons to drink water derived from a malarious region for from five to twenty days; the dust derived from the evaporation of water from the same source he caused to be inhaled by sixteen persons; and to five persons he gave rectal injections of the infected water. None of the persons thus experimented with developed malaria. Norton (Johns Hopkins Hosp. Bull., Mar., '97), in a recent review of the subject, states emphatically that in his opinion malaria is not a water-borne disease. JAMES C. WILSON and THOMAS G. ASHTON.]

Literature of '96-'97-'98.

If the transmission of malaria is aërial only, there are certain localities close to sources of malaria the freedom of which from infection cannot be explained. Transmission by drinking-water considered as more probable. Malarious countries have been traversed with impunity by drinking only boiled water, while villages have witnessed the disappearance of fever as the result of a supply of pure water. Experiments of Marino, Leri, and Baccelli quoted, however, to show that the theory of water-borne malaria is not altogether tenable. Laveran (Presse Méd., Jan. 20, '97).

2. The view that the malarial parasite may enter the system by way of the respiratory tract is still entertained by many, who, in support of their belief, instance the supposed influence of the winds in conveying the infection. The evidence is decisive, however, that, although the winds may carry the malarial organism, the distance through which this is probable is a very limited one. Numerous instances are on record of the anchorage of ships a very short distance off the coast of highly-malarious districts without any members of the crew, provided they do not land, contracting the disease. On the other hand, should members of such ship's crews land, infection almost invariably follows. Again, in many instances the moderate elevation of a residence, although surrounded by malarious swamps, will often prove effective in preventing infection; and it is well known that in a malarious district persons residing upon the ground-floor of a dwelling may become infected, while those residing in the upper stories will escape. Further, it is well recognized that the line of separation of certain malarious localities from the surrounding healthy region is, for some obscure reason, sharply defined: a circumstance which could not occur were the malarial parasite suspended in the atmosphere in such a way to be taken into the respiratory tract.

Investigation of the air in malarious regions, however, has given result that tend to confirm the theory. Maurel discovered in such air an amœba that he failed to find in non-malarious air, and the discovery of similar amœbæ in the nasal mucus he regarded as evidence that protozoa may be taken into the system by the respiration. Similar observations were made by Grassi and Calandruccio (Mannaberg), who discovered amœbæ in the nasal mucus of pigeons which for

several nights they subjected to the exhalations from swamps or malarial earth.

It may be stated, however, that the evidence for and against the respiratory theory of infection is inconclusive, and that positive proof of either contention is still wanting.

3. Much attention has, of late, been given to the study of the skin as the probable channel through which infection by the malarial parasite takes place. It has been conclusively proved by inoculation-experiments that infection may take place through this structure, and in addition that the different varieties of malarial parasites have each a more or less definite period of incubation when infection is brought about in this manner. This fact has directed attention to biting insects—more particularly blood-sucking insects—as the means by which the infection may be carried from infected to uninfected persons. The most likely of such insects is, of course, the mosquito, and the manner in which it may act as the intermediate host has been the subject of much recent experimentation.

> [The plausibility of the inoculation-theory is very much enhanced when comparisons are made between malaria and other parasitic blood-infections of man and the lower animals. It has recently been shown by Bruce, for instance, that the tsetse fly disease of Africa is due to a flagellate infusorium, and that the fly by feeding upon an animal already infected and then biting a healthy animal will act as a carrier of the parasite from the infected to the uninfected. In Texas fever, shown by Theobald Smith to be due to a protozoön, another illustration is afforded. In this disease the tick (*Boöphilus boris*) acts as the intermediate host, the tick falling from infected animals gives birth to a numerous progeny, which, in turn, infect other animals feeding in the pasture. (Sternberg, American Surg. Bull., April 10, '97.) It is also well known that the *Filaria sanguinis hominis* is carried from the sick to the well by the mosquito.
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> There are many circumstances associated with the conditions under which malaria prevails that may be reconciled with the theory that the mosquito is an important factor in the transmission of the parasite. Thus, the relative immunity possessed by those sleeping in the upper stories of a dwelling in a malarious region is susceptible of explanation by the limited extent to which the flight of mosquitos is elevated above the ground. Also, from the lessened resistance offered by the tender skin of children to the bites of insects may be explained the greater frequency with which they are infected by malaria in comparison to adults. It is only fair to state, however, that the advocates of the theory of infection by the respiratory organs explain the greater liability of children as being due to the fact that they are nearer to the ground than those of greater stature and are therefore exposed to the infection in a more concentrated form. The fact that sleeping upon the ground in a malarious region renders a person particularly liable to infection may be for the reason that he is thereby in a position most likely to be bitten by insects. Further, it is well known that mosquitoes are unlikely to leave the region in which they are generated, and that as soon as a strong wind prevails they seek such shelter that the wind carries them for a limited distance only. This may explain the very short distance malaria is carried by the winds.
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> Many interesting and valuable experiments have recently been made relating to the part played by the mosquito in the transmission of the malarial parasite. L. H. Warner (N. Y. Med. Jour., vol. lxviii, No. 24, Dec. 10, '98), in the study of this subject, bacteriologically examined various specimens of water obtained from the marshes of different malarious regions. In each specimen he found one or more forms of spirilla. These spirilla, however, produced no growth when introduced into culture-tubes of blood-serum and kept in an incubator from twenty-four to twenty-eight hours. Hu-

man blood was then collected from a number of persons by means of a sterilized hollow needle connected with the bulb of a syringe, also sterilized, and at once transferred to a blood-serum culture-tube, which was then placed in a thermostat and kept at a temperature of 100° F. A number of mosquitoes were then collected and kept in a sterilized bottle. From these by means of a platinum needle he extracted some of the albuminous poison with which mosquitoes are charged, and inserted some of it in each of the blood-serum cultures, which were then replaced in the thermostat. Examination made after twenty-four hours revealed a parasite not to be differentiated from the malarial parasite. As a result of these experiments he believes the mosquito to be an important factor in infection.

Most important results in this field have very recently been obtained by Bignami (Lancet, Dec. 3, 10, '98), whose investigations have proved conclusively that at least the most important method of transmission of malarial infection is by inoculation through the agency of the mosquito. Bignami's earlier experiments yielded only negative results, and experiments conducted as recently as August, 1898, failed to give a positive reaction. Investigations conducted by Ross, working in Calcutta, proving that the "dappled-winged" or gray mosquito is the only one concerned in the infection of birds with the *Proteosoma coccidia*, as well as the demonstration by Bignami, Bastianelli, and Grassi of the development of crescents in the middle intestine of a particular species of mosquito (*Anopheles claviger*), forced Bignami to the conclusion that these inoculation-experiments failed because the proper variety of mosquito was not employed. Following the publication of an article by Grassi in September, 1898, establishing the fact that certain species of mosquitoes were found in malarious districts which did not exist in healthy regions, Bignami repeated his experiments with mosquitoes obtained from highly-malarious districts. It is needless to mention that every assurance was had that the patients, the subjects of experimentation, had never been subjected to the possibility of malarial infection. The mosquitoes used in the first and unsuccessful experiments were found by Grassi to belong to the *Culex pipiens*, while those from which successful inoculations were obtained were identified as the *Culex penicillaris*, *Culex malariæ* (so called), and *Anopheles claviger*, these latter species being those found by Grassi in malarious regions, the *Culex pipiens* being the predominating species in regions non-malarious.

Bignami's experiment was begun on September 26, '98, and on November 1st following the patient was seized with a severe chil[1] The subsequent symptoms were those characteristic of an æstivo-autumnal infection and the success of the experiment was fully demonstrated by finding in the blood the æstivo-autumnal parasite. James C. Wilson and Thomas G. Ashton.]

Literature of '96-'97-'98.

At the present time there are only two theories as to the mode of transmission of malarial infection which are worthy of consideration,—namely, that it occurs aërially or else by inoculation through the agency of suctorial insects. Welch (Johns Hopkins Hosp. Bull., Mar., '97).

Transmission of malaria is by the mosquito. Infection occurs chiefly at night. Where there are no mosquitoes, there is no malaria. Thus there is a small island in German East Africa which is free of mosquitoes, and is also free of malaria. The Usamba region, at a certain height, is also free of malaria. It is also free of mosquitoes. R. Koch (Deutsche med. Woch., June 18, '98).

Mosquitoes not considered as essential for the conveyance of the parasites; they are not numerous in the fever-stricken districts on the West Coast; only appear for a short period in the year. Surg.-Capt. Duggan (Lancet, Mar. 27, '97).

While mosquitoes are almost confined to tropical and subtropical regions, malaria has a much wider area of incidence. A mosquito- and a malaria- map would be by no means correspondent in area, the former covering a much smaller tract of country than the latter. In seasonal

charts, too, the occurrence of malaria would be, with spring and autumn rises, continuous; that of mosquitoes, or their representatives in temperate regions, would be intermittent. William Sykes (Brit. Med. Jour., Jan. 1, '98).

The malarial parasite cannot be dependent upon man for its existence, because it is sometimes present in regions that were previously uninhabited. This cannot be explained by simply stating that the plasmodium lives and multiplies in the soil, and that man is merely an accidental host, for it would then be difficult to see how such a soil-parasite could adapt itself so perfectly to an animal organism, such as that of man; and it cannot be assumed that a mosquito or a gnat may serve as the host, for the introduction of one malarious patient into a district will not suffice to start an epidemic of the fever unless the suitable mosquito is at hand to carry the disease about. Andrew Davidson (Edinburgh Med. Jour., Oct., '98).

Whatever views may be entertained regarding other channels of infection, the following statement of Bignami well expresses the present *status* of the subject. "This much, at any rate, we can assert, namely: that inoculation is the only mechanism of infection which has been demonstrated experimentally."

General Symptomatology.

Period of Incubation. — No fixed period of incubation can as yet be given to malaria acquired in the natural way. While in the majority of cases it would appear to average from six to fourteen or twenty days, yet instances have been reported in which the disease developed within a few hours after exposure to the infection, and still other instances in which the evidences of infection did not occur for weeks or months after exposure. In the former class of cases, as studied by Plehn, the earliest evidences of supposed infection consisted of a single paroxysm immediately after exposure, no other paroxysms being experienced for several days subsequently. At the time of the first paroxysm examination of the blood yielded negative results, the parasite not being discovered until the paroxysms recurred, some days later. Instances of prolonged incubation are susceptible to the explanation that they are, in all probability, cases of relapses of earlier attacks that have been characterized by manifestations so mild as to be overlooked.

In view of our present knowledge of malaria some degree of variation in the length of incubation may readily be accounted for by the varying periods required for the development of the different forms of parasites. Further, inasmuch as the clinical manifestations of the disease begin when the parasite has developed into a group sufficiently large to produce a reaction at the time of sporulation, the period of incubation will also vary in accordance with the number of parasites originally introduced into an individual. This partial dependence of the duration of the period of incubation upon the number of parasites producing the infection is well shown in the cases in which infection is artificially brought about by inoculation.

Inoculation-experiments as determining the duration of incubation of malaria have been of much interest, and the varying results obtained in infection by the different forms of parasites correspond to the differences noted in cases that occur spontaneously.

[Mannaberg makes the following deductions from the results of his experiments: In five cases inoculated with the quartan parasite the minimum period of incubation was 11 days, the maximum period 18 days, and the mean period 13.4 days.

Seven cases inoculated with the tertian parasite showed a minimum incubation

period of 6 days, a maximum of 21 days, and a mean of 11 days.

Seven cases inoculated with the æstivo-autumnal parasite (with amœbæ, but without crescents) gave a minimum period of incubation of 3 days, a maximum of 14 days, and a mean of 6.5 days; while two cases inoculated with crescents without ("probably a few") amœbæ gave an incubation period of 13 and 15 days, respectively, or a mean of 14 days. James C. Wilson and Thomas G. Ashton.]

These experiments indicate that the longest periods of incubation are associated with the milder forms of infection, and that the grave infections, the æstivo-autumnal, show the shortest periods. In both instances inoculation-experiments coincide with clinical experience, and render easy of belief the probability that in the malignant cases of æstivo-autumnal infection the incubation may be brief.

Clinical Types.—Mannaberg divides the malarial fevers into two main groups: (1) the fevers due to infection with the ordinary tertian and quartan parasites of Golgi; (2) the fevers due to infection with the æstivo-autumnal or crescent-forming parasite.

Under these two main groups, which may also be termed, respectively, the regularly intermittent fevers and the more irregular, often continued or subcontinued, fevers, may be differentiated three separate types of fever: 1. Tertian fever, single and double infections. 2. Quartan fever, single, double, and triple infections: both types comprising the first group of fevers. 3. The second group of fevers, the æstivo-autumnal.

Tertian fever is of common occurrence in almost all malarial districts. The quartan type, while the common fever in a few malarial regions, such as certain parts of Sicily, is in most regions, where other varieties of infection are common, of rare occurrence. The following table is given by Mannaberg to illustrate the infrequent occurrence of this type in different parts of the world:—

Reporter.	Place.	Cases of Malaria.	Cases of Quartan Type.
Maillot	Bône, Algiers	2338	26
Finot	Blidah	4211	21
Durand de Lunel	Tenès	625	6
Osler	Baltimore	616	5
Laveran	Algiers	311	7
Griesinger	Tübingen	414	3
Mannaberg	Vienna	144	4

Æstivo-autumnal form of severe grade predominates in tropical and subtropical regions, and as these regions are departed from appears only in the late summer and autumn months; while the less severe forms, tertian and quartan fevers, occur earlier in the season.

Tertian Fever.— Single Infection, or Tertian Intermittent Fever.—In this form of fever the infection is with a single group of tertian parasites, each individual member of which is in approximately the same stage of development; so that segmentation of all, with which the paroxysm is associated, takes place at about the same time. As already stated, the time necessary for the completion of the cycle of development of the tertian parasite is about forty-eight hours, sometimes a little more, sometimes a little less, the latter more commonly than the former.

The Paroxysm.—The paroxysm may be divided into three stages: the chill, the fever, and the sweating stage.

The Chill.—Unpleasant feelings, ill-defined sensations of discomfort, usually precede the chill, and in an individual who has ever experienced a malarial outbreak are peculiarly significant of what is about to follow. Even at this time some elevation of the temperature may be noted. Occasionally the onset is abrupt and without premonitory manifesta-

tions. Gradually the chill develops from chilly sensations up and down the back early in the paroxysm until the fully developed rigor is attained. There is then chattering of the teeth and general shaking of the body, often so violent as to shake the bed upon which the patient is lying. While the surface of the body is cold, and the skin, owing to the erection of the hair-follicles, presents the condition of goose-flesh, the internal temperature, as determined in the rectum, is high, often 105° or 106°. The skin is pale, often bluish in color, and visual disturbances, headache, dizziness, nausea, and vomiting are common. The pulse is tense, small, and accelerated. The quantity of urine is increased. The duration of the chill is variable, usually from ten minutes to half an hour, or an hour, or even longer.

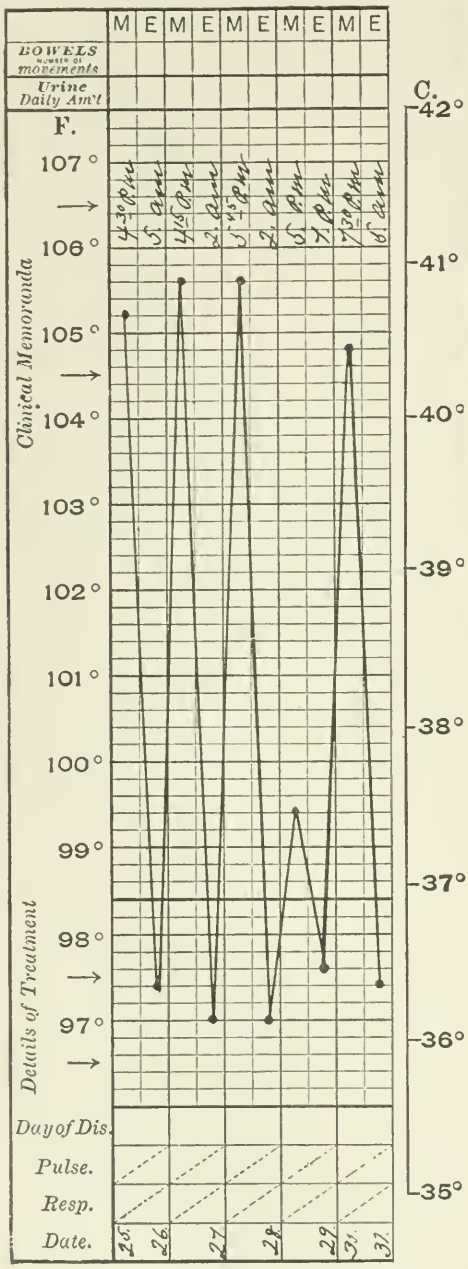
The Fever.—The febrile, or hot, stage gradually supervenes upon the stage of chill, until by repeated flushes of heat the stage of chill is completely superseded, and the patient throws off the additional bed-clothing which a short while before was so gratefully accepted. The skin becomes hot, dry, and reddened, and a sense of burning heat is complained of; the conjunctivæ are suffused; the pulse rapid, full, and bounding; intense headache, dizziness, and noises in the ears are often complained of; thirst, restlessness, and occasionally delirium occur, or the patient may be drowsy and somnolent. Constipation is generally present; epistaxis, diarrhœa, and vomiting are among the less frequently occurring symptoms. Cutaneous manifestations are of common occurrence, more particularly herpes of the lips and nose, while erythema and urticaria are sometimes seen. In most cases the splenic tumor may readily be detected. The duration of this stage is usually four or five hours, and the temperature now attains its greatest elevation.

The Sweating Stage.—With the initiation of this stage the patient experiences great relief. At first perspiration is noticed to occur about the forehead and upon the face, but shortly spreads over the whole body, usually becoming most profuse. The temperature rapidly falls, so that in two or three hours it has reached a subnormal point, where it generally remains for some time. Great relief from the distressing symptoms of the preceding stages is experienced, the pulse rapidly lessens in frequency, and the patient sinks into a refreshing sleep.

The Intermission.—The intermission continues until the young parasites derived from the segmentation that has caused the first paroxysm have, in their turn passed through their cycle of development until the stage of segmentation is attained, and with it occurs the second paroxysm. The time thus occupied is forty-eight hours, longer or shorter, resulting in anticipation or retardation of the paroxysm. During the intermission the temperature remains subnormal for some hours and the patient experiences great relief.

Double Infection or Quotidian Intermittent Fever.—In the blood will be found two groups of tertian parasites in different stages of development and reaching maturity or the stage of segmentation upon alternate days. In consequence, quotidian or daily paroxysms occur, which do not differ in their clinical manifestations from the paroxysms incident to single tertian infection. Inasmuch as one group may be larger than the other at the time of infection, it is not uncommon for the paroxysms to be tertian in type until the smaller group has attained sufficient size to cause a paroxysm. Further, as one group may,

throughout, be more numerous than the other, it is not uncommon for the paroxysms produced by this group to be more severe than those produced by the other. It is usual, also, for one group of parasites to undergo segmentation at a different hour from the other group, resulting, of course, in a constant difference in the hour of onset of the paroxysms.



Temperature-chart of double tertian infection, quotidian paroxysms. (*Philadelphia Hospital.*)

Infection with multiple groups of parasites is so rare as to be of no clinical importance. Such an occurrence, of course, would give rise to a very irregular type of fever. (See temperature-chart.)

Quartan Fever.—Single Infection.—The paroxysm in quartan fever is similar in every respect to that occurring in tertian fever. Examination of the blood shows the presence of a single group of quartan parasites the members of which are about in the same stage of evolution and attain the stage of segmentation at about the same time. The time required for the completion of the cycle of development is about seventy-two hours: so that the paroxysms, coincident as they are with the segmentation of the parasites, occur every fourth day, an intermission of two full days existing between. The paroxysm is characterized by the three stages of chill, fever, and sweating, and are of an average duration of about ten or twelve hours. They occur with great regularity and show but little tendency toward retardation or anticipation. (See comparative temperature-charts.)

Double Infection, or Double Quartan Fever.—This occurs when two groups of quartan parasites exist in the blood at the same time, and attain the stage of segmentation upon successive days. In this manner one day of intermission then follows. Upon examination of the blood the existence of these two groups can be readily observed. The paroxysms, which occur upon two successive days followed by a day of intermission, are in every respect similar to those occurring in single infection.

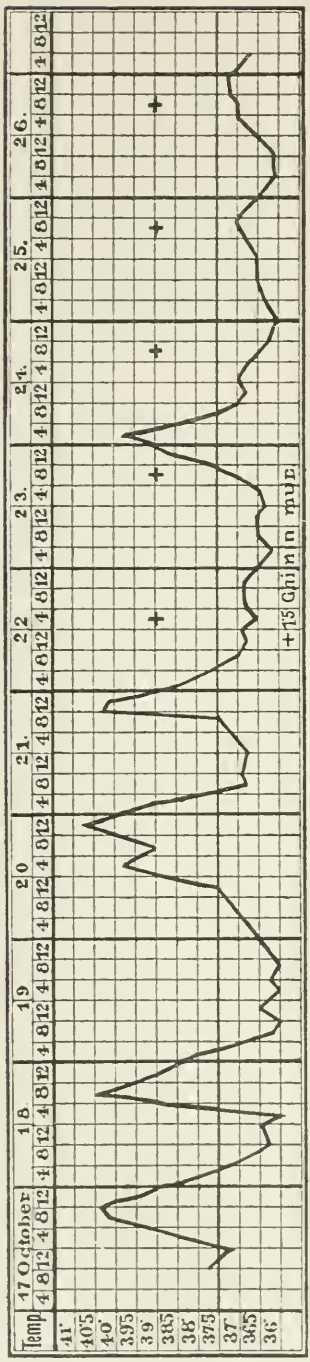
Triple Infection or Triple Quartan Fever.—This is due to the existence in the blood of three groups of quartan parasites in different stages of development and segmenting upon successive days. This results in daily paroxysms, or a quotidian intermittent fever, which only an examination of the blood will serve to differentiate from the quotidian intermittent fever due to infection with two groups of tertian parasites. The paroxysms are clinically similar to those with many exceptions in which the tendency to spontaneous recovery is seen,—pass on to a fatal termination with the development of pernicious symptoms when left to themselves.

This group of fevers, of course, depends upon infection with the æstivo-autumnal parasite and clinically is to be observed in many forms. Two principal forms, however, may be recognized: *quotidian intermittent fever* and *æstivo-autumnal tertian fever*, or *malignant ter-*

Quartan simplex: Silvestrini. (*Mannaberg.*)

already described as occurring in the single and double infections.

Æstivo-autumnal Fever. — The most important particular in which the fevers of this group differ from the regularly-intermittent fevers is the marked tendency which they show to become pernicious. The regularly-intermittent fevers when untreated tend to spontaneous recovery, and rarely, except in the most intense infections, develop grave, pernicious symptoms. The æstivo-autumnal infections, however,—of course *tian fever*. Owing to the marked irregularity which is a characteristic of almost all æstivo-autumnal fevers, it is not always possible to sharply classify the various cases. The chief reasons for the tendency toward irregularity in this infection are: 1. The cycle of development of the parasites is not so nearly simultaneous in the different members of the group as it is in the regularly-intermittent fevers, and as a result sporulation is not completed in the short space of a few hours, but continues to occur for



Quartan duplex. (*Mannaberg.*)

twenty-four to thirty-six hours. The consequence is the prolongation of the paroxysm. 2. The different parasites do not all take the same length of time to attain maturity, as is the case in the regularly-intermittent fevers, but show a marked tendency toward the hastening of sporulation, with resulting anticipation of the succeeding paroxysm. 3. Several generations, though seldom more than two, and mixed infections are of frequent occurrence. (Mannaberg.)

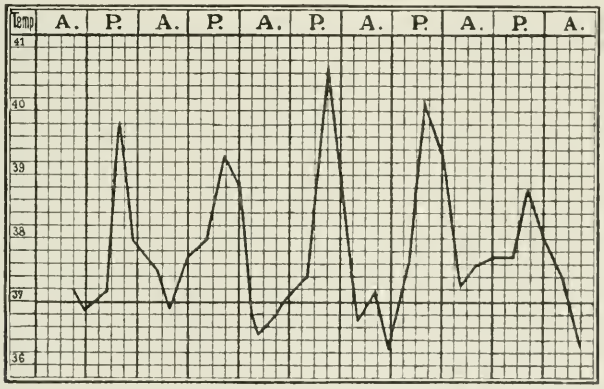
In quotidian intermittent fever of the æstivo-autumnal type the daily paroxysms may be so well defined that without an examination of the blood it may be impossible to differentiate it from double tertian or triple quartan infections. This is not the rule, however, for usually the paroxysm is much longer in duration, possibly twenty-four hours, while a chill may not mark the onset or may be very slight and not occur for some time after the temperature has become elevated. As a result of one of the causes just mentioned, after a few paroxysms the febrile movement no longer conforms to a type, but, from the prolongation of one of the paroxysms or the anticipation of the one succeeding, becomes so irregular that the interval marking the intermission becomes effaced or exists only as a slight fall in the temperature. (See temperature-chart.)

Malignant tertian fever, so designated by Marchiafava and Bignami to distinguish it from tertian fever of the regularly-intermittent type, is characterized by paroxysms occurring approximately every forty-eight hours. These observers describe the temperature-curve as possessing the following peculiarities: A rapid rise, frequently without a chill; with slight fluctuations the temperature remains high for several hours and then, not infrequently in the middle of a paroxysm, sustains a considerable drop, but not to normal (pseudocrisis); soon after,

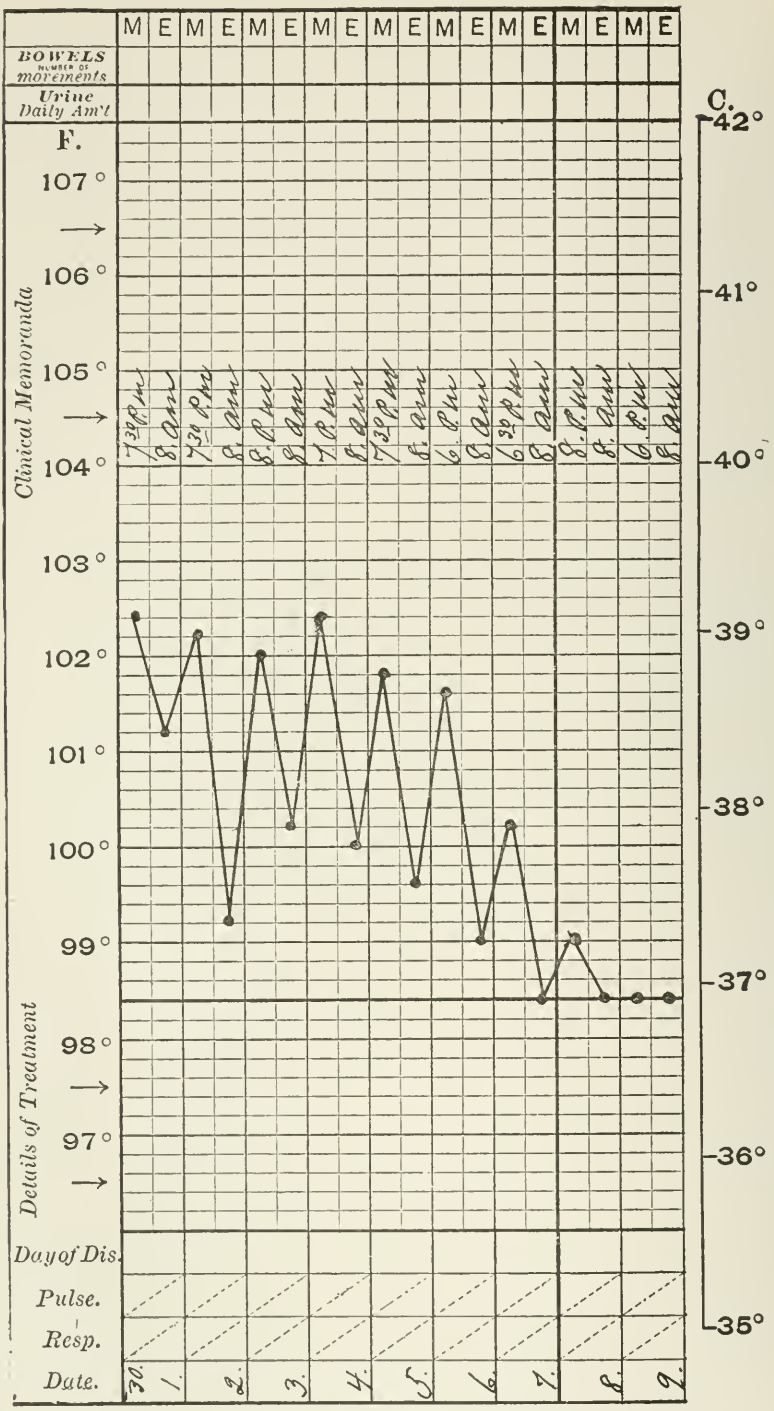
sometimes with a slight chill, the temperature again rises, often higher than it was at first, and after remaining there for some time finally falls to normal or below. The curve is thus divided by Marchiafava and Bignami into: the rise, the pseudocrisis, the precritical elevation, and the true crisis.

In the intervals between the paroxysms the temperature is frequently subnormal; inasmuch, however, as the paroxysms not uncommonly last thirty-six hours, or more, these intermissions are of very short duration. Although the paroxysms may occur at intervals of longer duration than forty-eight hours, it much more frequently happens that anticipation of the succeeding paroxysms occurs, so that the periods of intermission become so short that the temperature-curve becomes almost continuous, interrupted only by slight depressions or remissions to mark the interval between the paroxysms. In this manner occur the so-called *malarial remittent fevers*. In consequence of marked prolongation of the paroxysms or decided anticipation of succeeding paroxysms, so that one paroxysm begins before the preceding one is completed, many cases show a temperature-curve that is *continuous*. Even in these cases, however, it is usual for the temperature to show slight fluctuations indicative of the termination and onset of the various paroxysms.

These cases of malarial remittent or *continued fever* pass into a condition closely resembling typhoid fever, and under the name of typho-malaria have been the source of much confusion in their proper differentiation from typhoid fever. At the present day, and from the foregoing description of the manner in which these cases occur, it seems unnecessary to call attention to their essentially malarial nature. These cases of æstivo-autumnal fever may suddenly develop pernicious symptoms at almost any period of their course. They frequently so resemble typhoid fever that the distinction between the two is only possible as the result of a microscopical examination of the blood. The patient may complain of headache and general body pains, or there may be decided delirium or mental hebetude and somnolence. Very grave cerebral symptoms may at any time occur, such as stupor and coma; and convulsions, either general or local, may be observed. Intractable vomiting,



Quartan triplex: Marchiafava and Bignami. (*Mannaberg.*)



Temperature-chart of æstivo-autumnal fever, quotidian paroxysms. (*Philadelphia Hospital.*)

jaundice, and profuse diarrhœa, together with a dry, coated tongue and a collection of sordes about the mouth complete the resemblance to enteric fever.

Of 79 cases of typhoid fever treated to conclusion during the sixth year of the Johns Hopkins Hospital work, there were 13 that began with shaking chills. In 2 cases there were several severe rigors, in 3 cases there were two, while in 8 the rigor was single. Osler (Univ. Med. Mag., Nov., '95).

Literature of '96-'97-'98.

In a type of autumnal fever that appears annually between the 10th and 15th of August in Virginia, and continues until hard frost has set in symptoms analogous to typhoid fever are often witnessed. The temperature-curve of this prolonged remittent type and that of typhoid fever are almost identical, while many of the prodromal symptoms are similar. There are, however, no iliac gurgling, no rose spots; no tympanites, but rather retraction of the abdomen; and no intestinal hæmorrhage. The only test is the recognition of the malarial parasite. Bedford Brown (Charlotte Med. Jour., Jan., '97).

It is often hard to exactly differentiate existing conditions into symptoms directly associated with malaria and diseases consequent on malaria. Diseases may exist at the same time as the malaria, or may be induced by it; and only such conditions should be classified as symptoms as are the common conditions existing in malaria—for example, chills followed by fever, headache, sweating, vomiting, epistaxis, herpes labialis, bronchitis, and albumin in the urine. All these occur sufficiently often to make them characteristic of malaria when a number are taken together. Rupert Norton (Amer. Jour. Med. Sciences, Feb., '98).

Typho-malarial fever is not a special type of fevers, but represents a group of hybrids between typhoid fever and malarial fevers. Woodward (National Med. Review, May, '98).

At the Johns Hopkins Hospital in Baltimore, where hundreds of cases of typhoid fever and of malarial fever are seen, many coming from the neighboring Chesapeake-Bay region and from the Southern States, the "typho-malarial" fever of Southern writers is unknown, and only two cases of true combined typhoid and malarial infection have been seen. The reports from foreign countries in general are the same. I. P. Lyon (Amer. Jour. Med. Sciences, Jan., '99).

Particular mention must be made of those cases of æstivo-autumnal fever which are not characterized by a definite paroxysm and in which but a slight elevation of temperature occurs, and that irregularly. The patients in whom this irregularly-manifested infection occurs may complain only of headache, pain in the back and limbs, loss of appetite, and lassitude. This condition is, of course, accompanied by enlargement of the spleen, the characteristic malarial anæmia, and the presence in the blood of æstivo-autumnal parasites.

Pernicious Malarial Fever.—The development of pernicious characteristics in malarial infections depends probably upon one or more of several conditions. These predisposing factors are divided by Mannaberg into: (1) individual predisposition; (2) peculiarities of the parasites; (3) anatomical lesions.

1. There are persons who appear to possess a special predisposition to the development of pernicious symptoms upon exposure to infection, and who as often as they are taken ill with malaria develop the disease in one of its severe forms. It is probable that in such subjects certain peculiarities, either chemical or anatomical, may favor the elaboration of malarial toxins of more potent effect, or may influence the accumulation of infected blood-corpuscles within certain capillary areas. In others the predisposition may be temporary or acquired, as in alcoholics, those exposed to excessive heat, or bodily weak-

ness incident to overwork and deficient nourishment. It has also been observed that certain conditions predispose to the reference of pernicious symptoms to certain organs. Thus, it is observed by Baccelli that those whose work exposes them to the sun's heat frequently develop the comatose form, and that the same is true of alcoholic subjects, while persons previously suffering from intestinal catarrh are very likely to develop the choleriform type. In a highly-malarious region strangers who are unaccustomed to the climate are much more likely to develop pernicious malaria than the natives or those who have become acclimated.

2. Pernicious malarial fever is invariably due to infection with one of the varieties of parasites belonging to the second, or æstivo-autumnal, group, and of these varieties the one most frequently concerned, according to Marchiafava and Bignami, is the malignant tertian parasite. This being accepted as a fact, malignancy is found still further to depend upon the number of parasites existing in a given infection. In pernicious cases, while the number of parasites will be found to vary considerably, their number is always great. That the number alone is sufficient to explain malignancy many authorities dispute, and, while admitting the importance of their effect, the claim is made that pernicious symptoms arise in certain infections as the result of a higher degree of toxicity or virulency possessed by the infecting parasites.

3. The different anatomical lesions in pernicious malarial fever are sufficient to account for many of the malignant manifestations; these depend, for the most part, upon the occlusion of the lumina of the blood-vessels with the infected blood-corpuscles. Thus, by way of illustration, as a result of obstruction in the cerebral vessels numerous punctiform hæmorrhages ensue and grave cerebral symptoms occur.

Pernicious malarial fever may show itself as such from the very onset, and this is particularly so in highly malarious regions, or the occurrence of pernicious symptoms may be preceded by several ordinary paroxysms. From what has been said regarding the localization of the malarial parasites in the vascular system of certain organs, it may readily be understood that more or less distinct types can be differentiated. The most frequently occurring type is the comatose.

Comatose Form. — In this form the earliest manifestation may be suddenly oncoming coma; unconsciousness is profound and respiration stertorous and irregular, so that in many instances a striking resemblance to apoplexy is produced. More frequently, however, coma does not ensue until after the occurrence of one or more paroxysms uncomplicated with cerebral symptoms, or associated, perhaps, only with slight delirium and somnolence. Then, with deepening stupor or increasing delirium, coma supervenes. In other instances coma intermits, beginning with the elevation of temperature associated with the paroxysm, and ceasing with its decline, and this may repeat itself several times. In by far the greatest number of cases, however, coma continues, at times with occasional periods of slight improvement, and may thus last for three or four days until either death or recovery terminates the case.

In the comatose form of malarial fever the temperature-curve conforms to no particular type. The face is usually deeply congested, or may be pale if the pernicious symptoms occur in a person suffering from the anæmia incident to previous malarial infections. The pupils

may be dilated or contracted and usually react to light; occasionally they are unequal. The pulse may show increased frequency, or may be slow, and is usually of high tension, although it may be weak and compressible, especially toward the end of the paroxysm. The respiration may be increased or decreased in frequency and stertorous, and is frequently irregular, conforming to the Cheyne-Stokes type. The skin is hot and dry, and toward the end of the paroxysm may be bathed in profuse perspiration. Occasionally petechiæ are observed, and slight jaundice is not uncommon. Certain muscles may be the seat of local spasms, as evidenced by the occurrence of trismus or deviation of the eyeballs. Involuntary evacuation of fæces and urine occurs, although urinary retention is frequent. With the decline of the fever, coma, with the associated symptoms, disappears, and recovery may result from what is apparently the most profound infection. A second paroxysm rapidly follows the first unless energetic treatment be instituted, and this generally proves fatal. In other cases of this type of pernicious malarial fever delirium of a wild maniacal character may occur, and hallucinations and delusions are not infrequently seen. In still other cases convulsions of a tetanic character (perniciosa comatosa tetanica) are to be observed, and paralyses, hemiplegic or localized, are not uncommon.

Algid Form.—Usually after several preceding paroxysms lacking indications of anything extraordinary, the symptoms of the algid type set in. These do not occur during the cold stage, but usually immediately afterward, during the period of fever. At that time the patient passes into a condition of profound collapse. Arterial tension becomes at once lowered and the pulse is very compressible or, later, imperceptible. The eyes are sunken, the pupils dilated, the countenance drawn, assuming the Hippocratic expression. The mind remains clear, the lips are cyanosed, the tongue dry and cold; the surface of the skin is extremely cold and covered with a cold sweat; the rectal temperature is elevated. The patient complains of extreme prostration and of a distressing sense of internal heat, but does not appear to notice the coldness of the surface of the body; he is extremely apathetic and apparently unaware of, or indifferent to, the danger that threatens him. The abdomen becomes retracted, and by palpation the enlarged spleen may usually be detected; the heart-sounds are weak and feeble to the point of being inaudible. The symptoms are not dissimilar to those characterizing Asiatic cholera, and in a few hours death may terminate the case.

Syncopal Form. — In this form the chief symptom is the occurrence of attacks of syncope. The patient cannot make the slightest exertion, even turning from one side to the other, or merely lifting the hand, without at once passing off into a condition of syncope. Extreme weakness is complained of, the pulse is small, readily compressible, and accelerated. Should recovery from the first paroxysm take place, and treatment fail to prevent the onset of the second, death is then almost certain to occur. This form is closely related to the algid form.

Sudoriferous Form.—This type also belongs to the algid group of pernicious fevers, profuse and excessive sweating occurring during the last stage of the paroxysm; in many instances, however, the sweating occurs shortly after the beginning of the febrile stage, producing the impression that the paroxysm is to be shortened in duration. The contrary,

however, is the case, as in this type the paroxysm is usually greatly prolonged. With the onset of excessive sweating the patient rapidly passes into a state of collapse, with coldness of the surface and feeble, compressible pulse. This condition becomes progressively worse and terminates fatally unless relieved.

Cardialgic and Gastralgic Form. —This form is characterized by severe epigastric pains occurring during the paroxysm, usually commencing in the febrile stage and disappearing with its termination. The pain is sometimes reflected to the vertebral column and is frequently associated with vomiting, hæmatemesis, a sense of choking, and hiccough. Intestinal symptoms may occur, but not invariably. The patient very shortly passes into a condition of collapse, with weak pulse, coldness of the surface, cyanosis, and symptoms similar to those occurring in the algid form.

Choleriform Type. — The principal symptoms of this form are vomiting, profuse diarrhœa, and fever. At first the stools may be fæcal in character, but soon become serous, flecked with blood, and contain shreds of cast-off mucous membrane. Severe abdominal pains and cramps in the extremities are common; the surface becomes cold and moist, the pulse thread-like, and the extremities and face cyanosed; the clinical picture closely simulates the algid stage of Asiatic cholera. These symptoms have their basis in the localization of the parasites in the gastro-intestinal tract, the blood-vessels in the mucous membrane of which are found to be so choked with parasites that actual thrombosis may be produced, resulting in necrosis and ulceration. This form is one of the most commonly met with types of pernicious fever in the malarious regions of tropical and subtropical climates.

Bilious Form. — The fever in this form is usually of malignant tertian type, although at the beginning several well-defined quotidian or ordinary tertian paroxysms may occur. In this event, however, the fever soon becomes remittent or subcontinuous. The onset is frequently unmarked by a chill, and the sweating is often absent and insignificant. The vomiting of a large amount of bile-stained material is one of the chief symptoms, and is often uncontrollable. The stools are often deeply bile-stained, but may be serous and at times are bloody. Epigastric pain and, later in the case, hiccough are common. Jaundice is one of the most frequent as well as important symptoms; profound disturbance of the nervous system—as evidenced by delirium, stupor, coma, and ataxic phenomena—is frequently observed. Epistaxis and hæmatemesis also occur. The urine is deeply discolored with bile and, owing to the profuse vomiting and diarrhœa, is usually scanty. Uninfluenced by treatment, the case may continue for a week or ten days, and in spite of the most active treatment may terminate fatally in one or two days.

Hæmorrhagic Form. — Although of infrequent occurrence, a few of these cases have been reported. They are characterized by extensive hæmorrhages into the skin, epistaxis, profuse bleeding from the gums, or hæmoptysis.

Literature of '96-'97-'98.

Among soldiers of the Madagascar expedition, twelve cases of malarial retinal hæmorrhage, in all of which the cause was undoubtedly malaria. Albuminuria, cardiac diseases, and other conditions excluded as etiological factors. The hæmorrhages occurred suddenly, without painful phenomena, either at the height of the attack or in the subsequent period of anæmia or cachexia; and in most of the patients the spleen was much enlarged.

The site of the hæmorrhage was, in the majority of the cases, close to the disk, the macula being also affected in some cases. In five out of the twelve cases the lesion was unilateral, and there was usually more than one patch. The blood was absorbed rather rapidly, and, in the majority of the cases, great improvement in vision occurred simultaneously. These hæmorrhages attributed to parasitic thrombi, though the blood may have escaped through the wall. Bassères (Arch. d'Oph., June, '96).

Pneumonic Form. — It is probable that in this form there is a distinct localization of the parasites in the capillaries of the lungs. The onset is usually characterized by a marked chill, followed by a rapidly-rising temperature; severe pain may be experienced and referred to a particular part of the thorax. Marked dyspnœa, cyanosis, and cough accompanied with scanty expectoration, consisting at times of blood-streaked mucus, are striking phenomena. Physical examination results in no signs of a local lesion: simply diffused, fine bronchial râles unassociated with bronchial breathing.

Literature of '96-'97-'98.

There is no such thing as a malarial intermittent pneumonia nor a remittent pneumonic fever, nor a pernicious pneumonic fever. Laveran (Amer. Jour. Med. Sci., Feb., '98).

Malarial Hæmaturia; Febris Biliaris; Hæmoglobinuria; Black-water Fever.— This form of pernicious malarial fever occurs especially on the east and west coasts of Africa, and particularly in Madagascar. In Europe it is of uncommon occurrence except in Greece, where it is frequently seen; isolated instances of it are also observed in Italy and the neighboring islands. It would appear from the mass of evidence that the disease occurs only in those persons who have resided in highly-malarious regions for a considerable period of time and who have experienced previous attacks of malaria. Mannaberg is of the opinion that it rarely occurs during the first six months of residence in a malarious district. It would thus appear that by repeated infection with malaria an individual predisposition is produced to this particular form of the disease, although just what the conditions are creating this predisposition is not satisfactorily explained. It is claimed by some that anæmia is the chief causal factor. It would appear, however, that from some toxic substance present in the circulation, possibly produced by the parasite itself (Baccelli), such destruction of red blood-corpuscles ensues that the hæmoglobin is set free in the blood-serum in such enormous quantities that the liver cannot dispose of it, and hæmoglobinuria results.

The blood shows the presence of the æstivo-autumnal parasite as the exciting cause. The infrequency with which the affection is observed in temperate climates has led to the belief that the conditions appertaining to a tropical climate are necessary for its development. Anything which lowers the vitality of the individual, such as alcoholism, may constitute an important predisposing factor. Syphilis is held to possess a particular influence, owing to the analogy between paroxysmal hæmaturia and malarial hæmaturia. Physical fatigue and mental emotions are supposed to exert a certain influence. Changing from one locality to another in malarious regions is at times followed by an attack of the disease. An important rôle has been assigned by many to quinine in producing the hæmoglobinuric paroxysm.

[That this drug may have an unfavorable influence has been the subject of in-

vestigation of many observers, and it is thought by Plehn (Deutsch. Med. Hist., Nos. 25 to 28, '95) that its administration is often the determining cause of hæmoglobinuria; he further demonstrates that his cases of hæmoglobinuria treated with quinine did not pursue such a favorable course as those treated with other measures. It is asserted by Tomaselli (Mannaberg: Nothnagel's Spec. Path. u. Therap., B. 2, T. 2, S, 215) that in Sicily he has met with no instances of malarial hæmoglobinuria in which quinine has not been taken before the occurrence of the paroxysm, while Ughetti (Mannaberg, Nothnagel's Spec. Path. u. Therap., B. 2, T. 2, S. 215) goes still further and holds to the view that all such cases are in reality instances of the toxic effects of quinine, and that hæmoglobinuria bears no relation to malarial infection. The majority of observers, however, do not entertain these views. JAMES C. WILSON and THOMAS G. ASHTON.]

Six cases in which hæmoglobinuria repeatedly followed the administration of quinine. None of the patients could take the sulphate, 2 could not take cinchona in any form, 1 not the salicylate, 1 not the valerianate, 1 not the hydrobromate of quinine, without the recurrence of hæmoglobinuria. Coromilas (Jour. de Méd., Jan. 25, '91).

Literature of '96-'97-'98.

Black-water fever is more closely related to yellow fever than to malaria. The melanuria occurs only after the administration of large doses of quinine; and is not a symptom of the disease, but a result of the quinine therapy. Below (Med. Rec., Aug. 7, '97).

Hæmoglobinuria of malaria attributed not to the hæmoparasite, but to its toxins. Quinine may bring it on even in moderate doses. Four classes recognized: (1) pernicious malaria with hæmoglobinuria cured by quinine; (2) mild attaeks of malaria accompanied by hæmoglobinuria only when quinine is given; (3) hæmoglobinuria coming on in persons who have had malaria some time ago, and not associated with quinine; (4) hæmoglobinuria produced by small doses of quinine in persons who have had malaria previously. Quinine should be continued in spite of the hæmoglobinuria, if the malarial attack require it. Persulphate of iron and inhalations of oxygen also recommended. Baccelli (Policlin., Jan. 15, '97).

The recently expressed opinion of Professor Koch that hæmoglobinuria (black-water fever) is only another name for quinine poisoning is one calculated to do much harm. Out of 9 cases of black-water fever personally treated, 2 were fatal; in both the administration of quinine was neglected until too late. All the cases which recovered were treated with heroic doses (30 grains in twenty-four hours, and the attack lasted four days, the hæmoglobinuria subsiding gradually. In the other cases in which much larger doses were administered (60 to 120 grains in twenty-four hours) the hæmoglobinuria only lasted from twenty-four to thirty-six hours, and stopped quite suddenly. R. U. Moffat (Brit. Med. Jour., No. 1969, Sept. 24, '98).

Acute hæmorrhagic nephritis directly dependent on malaria, where the blood has been examined with positive findings, has been noted by a number of authors, and there is no doubt that it occurs, although the condition has been attributed to the effects of quinine given for its therapeutic effects in very large doses. But well-authenticated cases are reported where no quinine had been given when the condition was first discovered.

Hæmorrhagic nephritis is the possibility of a bacterial infection's being combined with the malarial. Rupert Norton (Amer. Jour. Med. Sci., Feb., '98).

As previously stated, malarial hæmoglobinuria usually occurs in those who have had repeated attacks of malaria, becoming evident during a relapse. Should it occur in a primary infection, which is rare, it is not commonly the initial symptom, but is usually preceded by a number of paroxysms. Fever, hæmoglobinuria, and jaundice are the principal clinical manifestations.

The fever may vary greatly in different cases: the type may be intermittent, remittent, or continuous, and the general

statement may be made that, the less the tendency is to the occurrence of intermissions or remissions, the more severe is the paroxysm. Unlike most forms of æstivo-autumnal fever, the onset of the paroxysm is almost always abrupt and is accompanied with a severe rigor. Profuse vomiting, intense body-pains, and pains in the head and extremities soon follow, the vomitus being dark and deeply stained with bile. In many instances constipation occurs, but in the graver forms there is a tendency to profuse diarrhœa, the dejections being dark and bile-stained. The pulse is rapid and at first of increased tension, while later it becomes weak and compressible. The conjunctivæ are suffused, the face is flushed and expressive of the great anxiety the patient is laboring under.

The *urine* varies greatly in specific gravity and is usually faintly acid in reaction. In the early stage of the paroxysm in which hæmoglobinuria occurs the urine is light red in color. This soon deepens, however, until during the height of the paroxysm it becomes dark brown or almost black. Owing to the presence of bile, this color is slightly tinged with green and the urine is frothy upon shaking. It is usually perfectly clear above the dark-brown sediment that is deposited upon standing. This sediment is made up of masses of pigment, mucus, epithelium from the bladder and kidneys, hyaline and granular epithelial casts, and, unless the case be one of true hæmoglobinuria, numerous red blood-corpuscles. The amount of urine, although generally reduced, varies greatly, and in severe cases may be almost entirely suppressed. It, of course, shows the presence of albumin in large amounts, and in some instances the presence of biliary pigments may be detected. Inflammation of the kidneys almost always accompanies, or follows, malarial hæmoglobinuria, and in some instances proves rapidly fatal with symptoms of uræmia. In mild cases, however, it is slight and soon passes away.

In all varieties of malaria the toxicity of the urine is increased from the beginning to the end of the attack, but not with any regularity of progression. The more toxic the urine, the more abundant the phosphates present and the deeper the color. Pensuti (Münch. med. Woch., Nov. 29, '92).

Literature of '96-'97-'98.

Conclusions drawn from study of 758 cases of malarial fever:—

1. Albuminuria is a frequent occurrence in the malarial fevers of Baltimore, occurring in 46.4 per cent. of our cases.

2. It is considerably more frequent in æstivo-autumnal infections than in other forms, occurring in 58.3 per cent. of these instances against 38.6 per cent. in the regularly intermittent fevers.

3. Acute nephritis is not an unusual complication of malarial fever, having occurred in 2.7 per cent. of the cases treated in the wards of the Johns Hopkins Hospital, and in between 1 and 2 per cent. of all cases seen at the institution.

4. The frequency of acute nephritis in æstivo-autumnal fever is much greater than in the regularly intermittent fevers, having been observed in 4.7 per cent. of the cases treated in our wards and in 2.3 per cent. of all the cases seen.

5. The frequency of albuminuria and nephritis in malarial fever, while somewhat below that observed in the more severe acute infections, such as typhoid fever, scarlet fever, and diphtheria, is yet considerable.

6. There is reason to believe that malarial infection, especially in the more tropical countries, may play an appreciable part in the etiology of chronic renal disease. William Sydney Thayer (Amer. Jour. Med. Sci., Dec., '98).

Jaundice is a constant symptom, and sometimes occurs as a prodromal manifestation; ordinarily, however, it first

occurs coincidently with the hæmoglobinuric paroxysm, and becomes most intense during the febrile stage; it usually continues for several days following the termination of the paroxysm.

In the milder cases decided remissions, or even intermissions, of the paroxysms occur, and with the fall in temperature the urine clears up and the jaundice lessens in intensity. From this point recovery may take place, but usually repeated paroxysms follow. In the severe forms the temperature remains continuous, and the intensity of the symptoms described becomes aggravated until a condition of collapse supervenes. Delirium is not usual and the patient is anxious and apprehensive. At times, with almost complete suppression, or the secretion of a very small amount of intensely-bloody urine, death may occur within several days. In these cases algid symptoms may be present; the pulse small, rapid, and weak; the surface of the body cold and bathed in cold perspiration; stupor, coma, or convulsions. In other cases profuse nosebleed, hæmorrhages from the mouth and bowels, constant hiccough, involuntary evacuation of fæces, and delirium close the scene.

Relapses. — The occurrence of fevers after long intervals of apyrexia and apparent health has long been recognized. Since the discovery of the malarial parasite many observers have endeavored to associate the occurrence of these cases with infection by a parasite whose cycle of development required a much longer period for its completion than that required by the parasites already described. It has already been pointed out that a malarial paroxysm does not follow the sporulation of a group of parasites until the group has attained a sufficient size to produce toxic effects at the time of sporulation. It has also been stated, in the brief allusion to the process of phagocytosis, that only a certain number of the young spores enter fresh corpuscles and complete again the cycle of development, and that a considerable number of them following sporulation are destroyed by some constituent of the blood-plasma and by the action of the phagocytes. In this manner a sufficient number of young parasites may be destroyed to prevent the immediate recurrence of the paroxysm, and it is only when, from the parasites that have escaped destruction, a sufficiently large group has been generated to produce symptoms that a paroxysm again takes place. Precisely the same effect is produced when malaria is imperfectly treated with quinine, as, for instance, the administration of a single dose of the drug following a paroxysm. A certain number of spores are destroyed sufficient to prevent the recurrence of the paroxysm at the usual time; the spores that escape infect fresh corpuscles, complete their cycles of existence, until after successive generations the group has become sufficiently large to produce a paroxysm. It may thus be seen that the intervals marking the occurrence of the paroxysms are prolonged and irregular, and may be from five to twelve days, or even longer. Fevers with long intervals may result in tertian and quartan infections, as well as in æstivo-autumnal infection, and they are to be regarded as relapses, occurring in the manner just described, and not as due to a particular variety of parasites whose cycle of development requires an extraordinarily long period.

The Blood.—The changes in the blood, aside from the presence of the parasites, are largely dependent upon the destruction of red blood-cells and the setting free of hæmoglobin. In all forms of malaria a reduction in the number of red

blood-corpuscles and in the percentage of hæmoglobin follows each paroxysm. In æstivo-autumnal infections this reduction is more decided than in the regularly intermittent forms, and the tendency to restitution to the normal between the paroxysms is not so marked. In tertian and quartan fevers the return to the normal number is very rapid.

The number of white blood-corpuscles is always less than normal, and the reduction is always greatest just after a paroxysm. A differential count shows a decided relative decrease in the percentage of polymorphonuclear neutrophiles, with a relative increase in the percentage of large mononuclear leucocytes. In certain instances of pernicious malaria a decided leucocytosis has been observed, doubtless due, at least in some of these cases, to secondary infections. In any event, the occurrence is of unfavorable significance.

General Etiology.

Climatic Conditions.—The influence of heat upon the development of malaria is clearly shown in the geographical distribution of the disease. It not only prevails to a much greater extent in tropical and subtropical climates, but in these regions it is encountered in its most intense forms; and, furthermore, as the temperate and colder climates are approached, the prevalence and intensity of the affection progressively decline; so that in those latitudes where the mean summer temperature does not exceed 15-16° C. malaria ceases to exist.

Season.—From these remarks it may readily be seen that the effect of season upon the prevalence of malaria exists in its fullest extent only in those regions characterized by marked seasonal differences in the temperature. In the tropics the disease prevails throughout the year, although its greatest virulence is to be observed during summer and autumn, while in temperate climates it is of uncommon occurrence in winter and spring. In tropical and subtropical climates, however, the maximum prevalence is attained in July, August, and September, when to the greatest elevation of temperature there is added the maximum amount of atmospheric moisture. It must be borne in mind, also, that not only the number of cases, but also their severity, is in direct relation to the temperature elevation. Thus, in temperate climates the mildest types are to be observed in the spring, and are then due to tertian and quartan infections, usually with a single group. With the approach of summer, infection with more than one group of the tertian parasite becomes of more common occurrence, and with the beginning of July the severer forms of fever due to æstivo-autumnal infection make their appearance, reaching their height during August, September, and October.

The recurrence of malaria in the winter and spring has given rise to the interesting question whether these cases are instances of fresh infection or whether they are relapses from infections received during the preceding malarial period? This question has as yet received no definite solution, although the experience of most observers tends to support the view that, while cases of primary infection occur in the spring, such cases are, of course, of more common occurrence during the more active malarial periods. Nevertheless, it is the experience of most of those entitled to an opinion that those cases of malaria occurring in winter are to be regarded as relapses from infection received during the preceding summer. It is further to be observed that malaria prevails to a greater extent, and with more severe manifestations, during warm

than during cold summers, and especially during warm summers accompanied by a high degree of atmospheric moisture. Heat alone, therefore, is not all-sufficient for the development of malaria, and only becomes of etiological importance when associated with other conditions presently to be discussed. The truth of this statement is exemplified in numerous communities in tropical climates where these combined conditions do not exist.

Moisture.—Much stress is to be laid upon the influence of moisture upon the development of malaria, and this is true equally of atmospheric moisture and telluric moisture. As above stated, in malarious regions the number of cases is usually materially greater during a summer attended by a heavy rain-fall than during a dry summer. In tropical countries the first notable increase in the number of cases occurs when the dry season is first terminated by the autumn rains, but when the rainy season has continued a sufficient length of time to more or less completely inundate the surface of the ground a decrease in the prevalence of the disease takes place. When, however, upon the termination of the wet season the sun regains its full vigor, the evaporation of the moisture from the ground that ensues causes the number of cases again to become largely augmented. (Mannaberg.)

The Winds.—Although it has been asserted that the winds play a certain part in the spread of the infection, they cannot be regarded as having any direct bearing upon the development of malaria. It has been long recognized that a growth of trees along the border of a malarious district appears to check and limit the distribution of the infection by arresting the miasmic-ladened winds. This limitation, however, probably depends upon other conditions presently to be described, and the winds cannot be regarded as a very important factor in the dissemination of the infection.

Telluric Conditions. — That the condition of the soil has some close association with the development of malaria there is much confirmatory evidence. It is a well-known fact that sailors and others on board ships anchored off shore in even highly malarious regions escape infection, while those from the same ships who land and remain on shore but for a short period contract the disease. This association between the soil and the malarial infection is strikingly illustrated in those whose occupations call for its disturbance. Thus, in malarious regions the infection is rife among those engaged in building railroads, canals, and kindred enterprises, and is usually then to be met with in its most intense and pernicious forms.

In general, malaria particularly prevails in low, marshy localities which are rich in decaying vegetable matters and in which the drainage is ineffective. Salt marshes are usually non-malarious, although marshes that are alternately fresh and salt as they may be subjected to inundation from neighboring fresh-water streams and from salt water at the flood of the tide are to be regarded as highly noxious. Malaria, therefore, is less likely to prevail when the geological conditions of the soil favor the rapid drainage of the moisture, or its prompt absorption. If, however, the conditions are such that the moisture is not rapidly absorbed by the soil, but is taken up by evaporation into the atmosphere, the disease prevails. In this connection a subsoil impervious to moisture is to be regarded as particularly favorable to the development of the infection.

Disturbance of the soil, even in districts where the disease has not pre-

viously prevailed, is at times followed by an epidemic of malaria. This association is, of course, greatly accentuated in regions already malarious; and, as already pointed out, the excavation of the soil in malarious regions for such purposes as railway and canal construction is apt to be attended by an outbreak of the severe forms of the disease. This is particularly liable to occur when such excavations call for the disturbance of rank vegetation or vegetable *detritus*.

From what has already been said, the effect of drainage upon a malarious region may readily be surmised. The instances in which the institution of a proper drainage has been followed by the entire disappearance of the disease from extensive regions in which it previously thrived are now too numerous to call for particular mention. In rather a direct ratio to the establishment of drainage of marshy regions and their subsequent cultivation a corresponding improvement takes place in the healthfulness of malarious districts. The planting of trees has been observed to be particularly effective in accomplishing this result, but it is not probable that one variety possesses more value in this respect than another. The advantage of a tree-growth, therefore, is to be ascribed more to the better drainage of the soil which it accomplishes than to any specific power possessed by certain varieties. The latter view was at one time quite largely entertained, and the marked improvement in the sanitary conditions following the planting of the *Eucalyptus globulus* in certain malarious regions afforded a basis for its belief. The abandonment of regions formerly subjected to a high degree of cultivation has been followed by malaria, often of a virulent type, although previously the disease was unknown. This fact is strikingly illustrated by the Roman Campagna, where, during the period of its cultivation, malaria was practically unknown. From the time of its abandonment, however, to within recent years, and even at the present day in certain sections, malaria prevails there with extreme intensity.

Altitude influences the development of malaria to the extent that with increasing elevations a corresponding decrease in the prevalence and intensity of the infection occurs, and, even in malarious districts, those residing in the upper stories of dwellings are less liable to the disease than those whose living-quarters are nearer the ground. While increasing elevation has the effect mentioned, it must be borne in mind that malaria may prevail wherever heat, moisture, and decaying vegetable *detritus* are to be found associated, and the increase in altitude simply diminishes the chances for the association of these conditions.

Geographically malaria is a widespread disease. In America the region of its prevalence is gradually becoming more and more restricted, and in many sections, notably the New England States and upper Atlantic sea-coast, where formerly it prevailed extensively, it has now ceased to occur except in the mildest forms. In the Southern States, particularly along the gulf and the Mississippi River, the disease is almost constantly present, while it is still to be met with in certain regions about the Great Lakes. In Europe, although the disease is still to be found in parts of France, Germany, and even England, its chief seats of activity are to be found in certain regions of Italy and in Southern Russia. Tropical and subtropical regions, however, where the telluric and other conditions already mentioned as favorable to its genesis exist, are the parts of the world

where malaria is to be particularly encountered and where it more or less constantly prevails.

Age has no direct influence upon the susceptibility to malaria. Those in the active periods of life contract the disease more frequently because they are more exposed to the predisposing causes, while the very young and the aged, only because they are less likely to be exposed, enjoy an apparent immunity. Exceptions to this statement will presently be noted.

Literature of '96-'97-'98.

Fatal case of pernicious malarial poisoning in a newborn infant. On morning of the day following delivery, mother had a chill. At the same time the child became comatose and cyanotic, cold, its face blue and pinched, and finger-nails blue, with rectal temperature 103.5°, and had rapid respiration. Victor Cadwell (Amer. Medico-Surg. Bull., July 25, '97).

Case of congenital malaria when child was 10 weeks old. Physical examination showed the patient to be much emaciated, pale and weak. Convulsions occurred daily since birth. When child was 11 weeks old, blood was examined and plasmodium malariæ found in abundance. The child was given 1 grain of quinine by the rectum in enema twice daily, and the convulsions ceased from this time, but muscular rigidity, sleeplessness, colic, constipation, and restlessness persisted.

Since patient did not improve nor gain in weight after a month's treatment with quinine, child was taken to a non-malarial place, where it began to improve immediately. The plasmodia were probably conveyed directly by means of the fœtal circulation, although there is a possibility of infection by the mother's milk. Kenelm Winslow (Boston Med. and Surg. Jour., May 2, '97).

Enlargement of the spleen in children is of little diagnostic value without a corroborative examination of the blood. Quite severe cases of tertian malaria occur in children in whom there is no enlargement of the spleen, and many cases in which the spleen is enlarged are not malarial. Henry Koplik (Med. Record, Feb. 5, '98).

Race appears to exercise a certain influence upon susceptibility to the disease; thus, the native inhabitants of malarious regions appear to possess a relative immunity. In America the negro possesses this insusceptibility to a considerable degree, and it has been estimated by Thayer, as the result of his observations in Baltimore, that this race possesses only about one-third the susceptibility that the white possesses.

[On the other hand, Frederick Smith (Brit. Med. Jour., No. 1981, Dec. 17, '98), from a study of immunity as illustrated by the incidence of the disease on various races in Sierra Leone, concludes that, while there is such a thing as immunity, it is only of a relative kind, and that such immunity as exists is acquired. From this stand-point, he believes that the negro possesses no special immunity. James C. Wilson and Thomas G. Ashton.]

Occupation is of considerable importance in its bearing upon susceptibility. Those whose pursuits entail disturbance of the soil in malarious districts, such as farmers, railway-laborers, and the like are particularly liable. Also those who are obliged to approach the swampy banks of rivers and inlets, such as fishermen, are rendered susceptible. Soldiers, probably because they sleep upon, or in close proximity to, the ground are very susceptible, as the malarial infection, as is well known, tends to cling to the soil.

Pathological Anatomy.

Acute Malarial Infections.—Our knowledge of the pathological changes in acute malarial infections is necessarily largely derived from a study of the condition of the internal organs as found in the grave forms of æstivo-autumnal infection, as cases of quartan and tertian infections rarely reach the post-mortem table.

Melanosis due to the accumulation of pigment derived from the hæmoglobin by the action of the parasites constitutes one of the most significant anatomical changes. The distribution of pigment in the various organs imparts to them a peculiar slaty-gray color, which is characteristic. Neither the malarial pigment nor the malarial parasite is distributed in the various organs with any degree of regularity. Not only is this irregularity manifested in different cases of infection with the same variety of parasite, but it has already been pointed out that in infection with the quartan parasite the peripheral blood appears to contain the organism in greatest number, while in tertian infection to a certain extent and in æstivo-autumnal infection to an almost exclusive extent the parasites are to be found in the blood-vessels of the internal organs. It thus becomes evident, not only that melanosis varies in different cases, but that pathological changes dependent upon the presence of the parasites are also irregularly distributed. It is also to be remarked that this varying distribution of the parasites in all probability has an important bearing upon the clinical manifestations.

Pigment is found to accumulate to a greater extent in the capillaries than in the blood-vessels of larger calibre, and the same is true of the pigment-laden parasites. Especially is the accumulation marked where the blood-current is retarded by the lessening of the calibre of the blood-vessel at the point where the artery merges into the capillary. Melanosis, therefore, as well as parasitic congestion, may be looked for in the capillaries of the cerebral convolutions, the dura mater, the pulmonary alveoli, the intestinal villi, and the glomeruli of the kidneys. Ordinarily, however, the blood-vessels of the spleen, liver, and brain show the greatest accumulations.

Literature of '96-'97-'98.

Characteristic effects due to long-continued malarial poisoning are mainly observed only in the liver, spleen, and kidneys. These effects are of two kinds: pigmentary and cirrhotic. In the former black and yellow pigment is found distributed through the organ, while in the latter the organ presents a thickening of its stroma and a growth of new connective tissue; and in each organ the pigmentary changes are mainly found in the less chronic, and the cirrhotic in the more chronic, cases. L. F. Childe (Indian Medico-Chir. Review, Feb., '96).

The Spleen.—The spleen is always enlarged, although in varying degree. Its consistency is diminished, often to such an extent that the attempt to remove it results in rupture of its tense capsule and the escape of its diffluent pulp. The pulp is frequently the seat of a melanosis varying in intensity from a dark-brown to almost a deep-black discoloration: it is sometimes evenly distributed over the entire organ and sometimes irregularly deposited. The cut surface is usually a dark-gray-brown or slaty color, and the unpigmented Malpighian corpuscles stand out prominently. The capsule is thin and easily torn. Microscopically, dilatation of the venous sinuses, often marked, is to be observed. The pulp contains enormous numbers of red blood-corpuscles, which in greater part are found to be infected with parasites in all stages of development, while occasionally free parasites are to be found.

The presence of large numbers of phagocytes, particularly the large cells known as macrophages previously referred to, is a marked characteristic. While leucocytic phagocytes occur, the predominating variety is this large cell, which exists in very considerable num-

bers. The protoplasm of these cells is seen to contain pigment-granules, in clumps or rods, as well as parasites free or included within their corpuscular hosts. The parasites, which are in various stages of development, often complete their cycle of existence while thus contained within the macrophages, and the latter not infrequently show evidences of necrosis; a probable result of the destructive effect of the parasite. The splenic veins, while containing phagocytes laden with pigment, contain comparatively few infected blood-corpuscles; with the latter, however, the capillaries are usually filled.

Capillary thrombosis may be the cause of necrotic foci scattered throughout the structure of the spleen. The spleen in all cases does not present marked melanosis, and in many cases is relatively free from both pigment and parasites.

The Liver.—In most cases the liver is somewhat enlarged and, from the large number of parasites and pigment contained within its capillaries, is of a dark-slate-colored hue, often almost black. Microscopically, the capillaries of the hepatic artery, of the portal vein, and of the hepatic vein are found to be crowded with pigmented parasites. In the branches of the portal vein may be seen the very largest macrophages, which have originated in the spleen and which, on account of their large size, obstruct the calibre of the vessels. The hepatic cells are swelled and often contain pigment, and at times fragments of red blood-corpuscles may be observed within them. The capillary endothelial cells not infrequently show the presence of pigment as an evidence of their phagocytic action, and as they are often considerably swelled the capillary lumen becomes correspondingly limited. In the periportal connective tissue a small-cell proliferation is not infrequently to be observed, which may be the starting-point from which occurs the hepatic cirrhosis at times noted as a sequel to malarial infection (Mannaberg).

> [Barker (Johns Hopkins Hosp. Reports, vol. v, '95) describes the occurrence of scattered foci of local necrosis of the liver-tissue, depending, probably, upon capillary thrombosis brought about by various forms of leucocytes. They are very similar, however, to analogous changes occurring in other acute infectious diseases, in which their occurrence is ascribed to the action of circulating toxins. James C. Wilson and Thomas G. Ashton.]

The liver in most cases shows a varying degree of hyperæmia, which accounts, to a certain extent, for the enlargement of this organ. To the hyperæmia, also, as well as to the large amount of pigment deposited in the organ, is to be ascribed its increase in weight.

The Kidneys.— The macroscopical changes so apparent in the liver and spleen are not often to be observed in the kidneys. Nevertheless, at times, points of pigmentation can be detected within the cortex or along the course of the vessels in the pyramids. Microscopically, pigmentation to a considerable extent may be observed, especially in the glomeruli, the pigment being contained within large leucocytes, which may produce a narrowing of the calibre of the vessels; at times the endothelium of the glomeruli may be pigmented. Degeneration and desquamation of the epithelium of the capsules of Bowman constitute one of the most serious lesions, while in the tubules may be found, here and there, areas of necrotic epithelium.

In hæmoglobinuric, or black-water, fever the changes in the kidneys are most marked. They are usually increased in size, of somewhat lessened consistence,

and of varying color, being frequently pale and anæmic in appearance; less frequently they are a darkened color. Upon the surface of the organ, especially when it is pale, are to be observed scattered brownish spots due to pigment-deposits which crowd the epithelium and lumina of the uriniferous tubules. Kiener and Kelsch (Arch. de Phys. Norm. et Path., '92) have also described the appearance of intratubular hæmorrhages within the pyramids, as a result of which this portion of the renal structure assumes a deep-red color. Microscopically the renal epithelium is found to contain pigment; and pigment-rodlets, or fine-yellow granules, or dark, amorphous masses, are observed to fill the lumina of the uriniferous tubules. Usually some of the tubes are filled with blood-corpuscles, and sometimes the evidences of a beginning nephritis are found.

The Gastro-Intestinal Tract.— Except in a few instances, the gastro-intestinal tract shows but little change other than that arising from the deposit of pigment. Microscopically the capillaries of the mucous membrane may be found to contain parasites as well as phagocytic cells containing pigment in greater or less amount.

It has been shown by Bignami, however, that in certain instances the gastro-intestinal tract may constitute the point of chief localization of the infecting parasites. These cases, clinically, usually present the manifestations characteristic of the choleraic form of pernicious fever. Microscopically there may be intense injection of the mucous membrane of the stomach and intestines, with numerous punctiform hæmorrhages. The capillaries of the mucous membrane may be crowded and their lumina obstructed with parasites, which may be contained within phagocytes, or red blood-corpuscles, or may exist free. These thromboses result in necrosis of the epithelium of the mucous membrane with superficial ulceration. Barker (Johns Hopkins Hosp. Reports, vol. v, '90) reports a case in which the capillaries of the mucous membrane were so blocked with parasites contained within mononuclear macrophages that numerous small, circumscribed areas of necrosis of the mucosa resulted.

The Lungs.—In many cases areas of broncho-pneumonia or infarction are to be observed, and it is somewhat noteworthy that the areas of broncho-pneumonia do not, as a rule, show the presence of pigment. Microscopically the capillaries of the alveoli are found to be filled with infected blood-corpuscles and macrophages.

The capillary endothelium infrequently contains pigment, although the large number of phagocytes contained within the alveolar capillaries may lead to necrosis. It is unusual to find pigment-containing leucocytes in the interior of the alveoli.

The Heart and Muscles.—The cardiac muscle is frequently pale, softened in consistence, and shows the evidences of fatty degeneration; the same changes may be observed in the general muscular system. This degeneration of the myocardium and of the voluntary muscles may in part be due to the blocking up of the capillaries with parasite-containing blood-corpuscles and cells.

Literature of '96-'97-'98.

Many authors believe that malaria may cause definite heart-lesions, but again there is not a single case reported which is of convincing evidence, and as negative proof against this theory Laveran and the other authorities on malaria hold the opposite view. Norton (Amer. Jour. Med. Sci., Feb., '98).

The Bone-marrow.—The bone-marrow is of brown-red color, sometimes almost black; it is soft, almost diffluent. The vessels are found to contain developing, as well as sporulating, parasites, and crescents are usually present in abundance. About the periphery of the lumina of the vessels macrophages containing pigment may be found in considerable numbers. Nucleated red blood-corpuscles, which sometimes exist in great numbers, do not contain parasites (Mannaberg).

The Brain.—Macroscopically the brain may show but slight evidence of change, and melanosis may not be present. Usually, however, a distinct localization of the infected blood-corpuscles appears to take place in the cerebral capillaries, and then melanotic discoloration, especially of the gray matter, may be observed. Marked discoloration of the cortex may thus occur, with deep injection of the blood-vessels and, not infrequently, numerous punctiform hæmorrhages. These changes are to be particularly observed in instances of pernicious fever of the comatose form, and in such cases the microscopical findings are remarkable. Parasites in all stages of development, although one stage usually predominates, crowd the cerebral capillaries until, in places, complete obstruction or thrombosis of their lumina takes place. These parasites, although commonly seen to be within red blood-corpuscles, may be free, or contained, together with pigment or blood-corpuscles, within phagocytes. The latter may be macrophages, leucocytes, or may be derived from the endothelium of the capillaries.

Chronic Malarial Infections and Chronic Malarial Cachexia.—Numerous pathological changes are to be observed in the organs of those who have been the subjects of long-continued infection with malaria; the most noteworthy of these changes occur in the spleen, liver, and bone-marrow.

The Spleen.—Notable enlargement of the spleen always occurs, and thickening of its capsule is usually to be found. This thickening, as a rule, is not evenly distributed, but is apt to show as scattered islets. Not infrequently these islets, or plaques, are cartilaginous in character, and occasionally ossification of the capsule takes place. The consistence of the enlarged spleen is much increased and its border is usually well defined. Its color is usually red, but not infrequently it has a grayish-brown or slaty color. The cut surface shows marked prominence of the trabeculæ, which corresponds to the degree of increase of the connective tissue and thickening of the sheaths of the vessels. The veins are dilated to such an extent as to simulate angiomata, and the Malpighian bodies are but slightly apparent.

The microscopical changes are significant. Shortly after the termination of the actual infection a cessation of the acute hyperæmia occurs and necrotic areas develop in the pulp, while some of the follicles also become necrotic and fibrous. In addition, extensive regenerative changes take place, originating largely from the follieles, which become markedly hyperplastic; hyperplasia of the elements of the pulp is also to be observed. The arrangement of the pigment becomes changed: it gathers in small clumps in the pulp and becomes concentrated in the sheaths of the vessels and the connective tissue of the septa. The macrophages, which in the acute tumor are the carriers of the pigment, disappear, probably as the result of degeneration, and the pigment in the chronic tumor becomes extracellular (Mannaberg). Subsequently the pig-

ment disappears completely. While absorption of the areas of necrosis takes place, dilatation of the vessels and hypertrophy of the septa become more marked and the splenic pulp becomes so compressed as to entirely disappear. The final result of these changes is that the function of the spleen is entirely destroyed and the recognition of its histological elements becomes impossible.

The Liver.—The liver is increased in volume and weight, at times very greatly: its surface is smooth and its consistence increased; thickening of the capsule is of frequent occurrence. The cut surface is found to vary somewhat in accordance with the duration of the infection. In general, the lobules are slightly prominent and quite distinct, while the appearance of the surface is finely granular.

The changes to be observed by microscopical examination are thus summarized by Mannaberg from the researches of Bignami. Shortly after the termination of the acute infection it will be noticed that the parasites have disappeared from the capillaries, the endovascular macrophages are no longer to be seen, and the pigment is entirely collected in the endothelium and in Kupffer's cells. A decided atrophy occurs in those parts of the liver-lobules in which necrosis has taken place and the vessels become dilated. The lobule is further freed from pigment, which is carried by the mononuclear and polymorphonuclear leucocytes to its periphery. At the same time the beginning of regenerative changes becomes apparent in the liver-cells.

The next stage is that which, in consequence of the atrophic and regenerative processes, leads, on the one hand, to the development of pseudo-angiomata and lymphatic cysts, and, on the other, to the formation of abnormally-large lobules. The pigment is carried out of the vessels by the leucocytes and deposited in the perivascular lymph-spaces, while the perilobular connective tissue becomes hyperplastic.

The final result is a large, dense liver, of a reddish color, which upon section shows the finely-granular lobules to be surrounded by trabeculæ of connective tissue. The vessels are dilated and the organ is congested, while pigmentation is no longer to be seen. Kelsch and Kiener assert that a few months after the termination of the acute infection pigment is no longer to be found, and Bignami has observed that it has, in large part, disappeared in from three to four months.

The development of a true atrophic cirrhosis of the liver due to malarial infection is as yet an undecided question, and must be, in any event, of rare occurrence. Kelsch and Kiener, however, distinguish three forms of chronic malarial hepatitis ([1] with hyperæmia; [2] with cirrhosis; [3] with adenomata) and two groups of cirrhosis ([1] insular cirrhosis with nodular hepatitis, and insular cirrhosis with diffuse parenchymatous hepatitis; [2] annular cirrhosis, with nodular or diffuse parenchymatous hepatitis).

Both Marchiafava and Bignami deny that true cirrhosis follows malaria, and make the following distinctions: In the case of malarial cirrhosis or hepatitis the increase in the connective tissue is perilobular, and surrounds the individual lobules, and the branches of the portal veins are not obliterated. In true atrophic cirrhosis the hyperplastic connective tissue surrounds a number of lobules, retracts upon them, and leads to compression of the portal vessels. The changes taking place in the liver-cells in the two conditions are also different, being, as the result of malaria, of a grave nature and primarily local, while in true

atrophic cirrhosis they depend upon the newly-formed perilobular connective tissue.

The Bone-marrow. — The marrow of the long ones, particularly in the upper and lower portions, is usually red and its consistence somewhat increased. The microscopical examination reveals proliferation, more or less active, of the cellular elements of the marrow, and greatly increased vascularity. The mononuclear myelocytes, both large and small, are increased and many of them show evidences of degeneration. Nucleated red blood-cells, or normoblasts, are found in large numbers, as well as a few megaloblasts or gigantoblasts. Pigment disappears from the bone-marrow much earlier than from the other organs. In rare cases the marrow presents the same features as is found in pernicious anæmia, showing a considerable number of gigantoblasts and megaloblasts.

The Kidneys.—No marked changes occur in the kidneys in chronic malaria. Kelsch and Kiener, however, describe two forms of kidney occasionally met with in this condition: the congested form and the atrophic form. The histological changes characterizing these conditions seem hardly called for in the scope of the present article.

Diagnosis.—The diagnosis of malarial fevers mainly depends upon the result of the examination of the blood, and the more doubtful the case, the more it resembles some other affection, the more necessary is a resort to this means of attaining a positive conclusion. To a less degree the diagnosis is established by the results of the therapeutic test: *i.e.*, the administration of quinine and the clinical manifestations.

In many cases the symptom-grouping, the regularly-recurring paroxysms, and the orderly sequence with which the various stages succeed one another may be quite sufficiently characteristic to warrant the diagnosis of malaria. This is particularly true if the case be one of single tertian, single quartan, or double quartan infection, for no disease through any considerable period of time will present such regularity in the recurrence of the febrile paroxysms. There are many affections frequently encountered, however, which offer some difficulty in differentiating from malarial fever of quotidian type whether due to double tertian or triple quartan infection.

Pulmonary tuberculosis—from its wide prevalence and the fact that it is frequently attended by daily febrile paroxysms consisting of more or less well-defined stages of chill, fever, and sweating —is probably more commonly mistaken for malaria, in regions where the latter affection prevails, than any other disease. Only ignorance or carelessness, on the part of the physician, however, can result in confusing the two maladies. In tuberculosis the absence of splenic enlargement, the anæmia's lacking the peculiar sallowness of malaria; the occurrence of the febrile paroxysm in the later hours of the afternoon instead of the forenoon, except when the inverse type of fever prevails; the result of the physical examination of the lungs, the presence of tubercle bacilli in the sputum, and the result of the blood-examination constitute a group of events which, when properly interpreted, preclude the possibility of confusion between these two diseases.

Other septic processes may be confused with malarial fever, such as the fever accompanying malignant endocarditis; septic processes involving the biliary passages or the genito-urinary organs, as pyelitis, pyelonephritis, or urethral fever, so called, arising from

gonorrhœa or the introduction of instruments into this passage; the fever associated with malignant new growths, or empyemata in various locations. In all these instances the previous history of the case, the results of the physical examination and the examination of the blood will decide the diagnosis. Of these, of course, the most important is the blood-examination; the absence of leucocytosis, or actual reduction of the number of leucocytes, and the presence of parasites in malaria; the presence of leucocytosis and absence of parasites in the various forms of septicæmia.

The æstivo-autumnal fevers may also be confused with tuberculosis and other septic processes particularly in those instances where the intervals between the paroxysms are well marked. The same means of differentiation are to be invoked, however, as in the case of the regularly-intermittent fevers. When by retardation and anticipation of the paroxysms, however, the intervals between them become almost or completely obliterated, æstivo-autumnal fever may so resemble typhoid fever that an examination of the blood becomes necessary to establish the diagnosis. Here the presence or absence of the parasites must alone be depended upon, as in neither disease does leucocytosis occur. Clinically the persistence of a trace of the paroxysm, the presence of jaundice, early anæmia, herpes or urticaria, and the relative infrequency of Ehrlich's diazo-reaction in the urine will aid in confirming a diagnosis of malaria.

> Four undoubted instances in which the co-existence of malaria and typhoid has been actually proved by microscopical blood-examinations. These at least are all that it has been possible to find on record.
>
> Other than irregularity of fever, and occasionally chills, there is nothing in these cases of mixed infection by which to suspect their nature, and the course of the typhoid malady is not influenced; it only proves how necessary it is in all instances of typhoid fever, especially of the irregular kinds, to make blood examinations for malarial parasites. J. M. Da Costa (Internat. Clinics, vol. ii, Seventh Series).

The PERNICIOUS FORMS OF MALARIA are to be separated from conditions with which they are likely to be confounded chiefly by an examination of the blood. In these forms confusion may arise between the hæmorrhagic type and yellow fever, the choleriform type and Asiatic cholera, the comatose type and insolation, and the hæmoglobinuric type and ordinary paroxysmal hæmoglobinuria. To the observer the examination of the blood may constitute the only positive means of reaching a definite conclusion.

Chronic malarial cachexia is to be differentiated from the grave anæmias, leukæmia, and pseudoleukæmia by the examination of the blood, or, when this fails to give positive results, by the early history of the patient and the amenability of the condition to proper remedial measures.

The administration of quinine is the therapeutic test for malaria, and is of importance if it be impossible to make a microscopical examination of the blood. Under the influence of proper doses of this drug no malarial fever will persist for more than four or five days.

Literature of '96-'97-'98.

> Neglect of examinations of blood has led to the gravest mistakes. A patient presented herself to a surgeon, complaining of pain in the lower abdomen, pelvis, and back, with chills and fever. Upon examination a mild pelvic peritonitis was found. She was advised to have the tubes and ovaries removed, and submitted to the operation. The patient had a severe chill the next day, followed by a rise of

temperature to 107°, and collapse. The blood was then examined and found teeming with malarial organisms. The patient eventually recovered, but nevertheless the operator was negligent in not excluding by systematic study of the case the possibility of malarial infection, before performing what proved to be an unnecessary mutilating operation. W. W. Russell (Johns Hopkins Hosp. Bull., Nov. and Dec., '96).

Cases of malaria illustrating its various manifestations. One commenced with symptoms of catarrhal dysentery without chill or variation of temperature, the symptoms exhibiting periodic exacerbation. In another case there was severe diarrhœa, with two days' intermission and considerable malaise; in another diarrhœa of three weeks' duration. A case of ulcerative stomatitis was cured on three occasions with quinine. Other cases presented urticaria, conjunctivitis, leg-ulcers, periodic pains in the knee, Bell's palsy with periodic fever, paralysis of the extensor muscles of the right hand, with the development ultimately of typical intermittent fever. In all of these cases but one the malarial parasite was found in the blood, sometimes only after repeated examinations, and quinine caused prompt recovery. R. A. Goodner (Med. News., Dec. 17, '98).

Complications and Sequelæ. — Complications are, in great part, the result of mixed infections with other morbific agents, and comparatively few are due to the direct action of the malarial toxin, although some may arise from causes that are purely mechanical.

The Lungs. — Croupous pneumonia and broncho-pneumonia may occur as true complications of malaria, and are then, of course, to be considered as due to secondary infections, and not as a result of the specific malarial toxin. The latter may render the person more susceptible to pneumococcic infection by impairing the general resistance, but no more intimate relation exists between the two diseases. Of course, the conditions already described as associated with the pneumonic form of pernicious fever in all probability depend upon the localization of the parasite in the pulmonary blood-vessels and are therefore directly due to the malarial infection; but this is not a true pneumonia and is unaccompanied by the signs of consolidation.

The association of *pleurisy* and malaria may occur and, as with pneumonia, is to be regarded as purely accidental and in no wise a consequence of the original infective process.

Tuberculosis.—The malarial subject is equally as liable to pulmonary tuberculosis as the non-malarial. This is contrary to the views held by early observers, who, following the lead of Boudin (Traité des Fièvres Intermittentes, Paris, '42), adopted the view that the two infections were in some manner incompatible with each other. As a matter of fact, in warm climates where malaria prevails its association with tuberculosis is uncommon because the climatic conditions are such as limit the occurrence of this infection, and in regions where tuberculosis prevails malaria, as a rule, is infrequent. To climatic conditions, therefore, rather than to any antagonism between the two infections is to be ascribed their relatively infrequent association in the same subject.

Typhoid Fever. — The relations between typhoid fever and malaria are the same as between malaria and other infective processes. From our present knowledge of malarial fever and the aid in diagnosis afforded by the microscope we know that there is no distinct clinical type of the disease to which the term typho-malaria may be properly applied. The class of cases, the continued forms of æstivo-autumnal fevers, which have been the source of so much confusion respecting the two infections, have

already been referred to. The examination of the blood in these cases and the action of quinine afford means of diagnosis as easy of application as they are decisive in results. An acute malarial infection or the lighting up of an old one may occur in the course of typhoid infection, and the symptoms of the latter may be so modified as to indicate the character of the complication, but the two infections complete their course independently of each other and their association does not give rise to a new clinical or pathological entity.

Infections other than typhoid fever, such as the eruptive fevers, acute rheumatism, and the like, bear the same relation to malaria.

Chronic Malarial Cachexia.—As the result of neglected cases of malarial fever, usually of the æstivo-autumnal variety, or as the result of inadequate treatment by quinine, a series of relapses occur which eventually give rise to such impairment of the general health as to establish a chronic cachexia. This is the most frequently met with sequel to malarial fever and first manifests itself as an anæmia, which, if the cause be not removed, may develop to the gravest proportions. The patient's appearance becomes distinctive, and, with the evidences of profound anæmia, the skin presents a sallow or muddy color; the mucous membranes are all but colorless, while the extreme exhaustion, breathlessness upon the slightest exertion, headache, and subcutaneous œdema indicate the gravity of the changes that have occurred in the blood. Digestive disturbances are common and the tongue is frequently coated. Great enlargement of the spleen, the most pronounced that may be encountered, occurs in this condition, giving rise to the popular term of "ague-cake." Neuralgia, especially of the supraorbital and intercostal nerves, is a common incident and the occurrence of vertigo upon any sudden change of position may interfere with the patient's locomotion. In advanced cases dropsical effusions into the serous cavities may take place, while marked emaciation, exhaustive diarrhœa, anorexia, and profound asthenia render the patient particularly susceptible in intercurrent infections.

Chronic malarial cachexia may pursue throughout an afebrile course or it may be punctuated by irregularly-recurring paroxysms of mild pyrexia; in still other instances an irregular, subfebrile temperature may exist for a long period. While any variety of malarial infection may be followed by cachexia, it usually occurs as a sequel to the æstivo-autumnal. The blood-examination may be negative. In æstivo-autumnal infections, however, crescents and ovoid bodies are nearly always found, while in other infections pigmented leucocytes and a few parasites are usually to be seen.

Relapses. — This sequel has already been referred to as arising from the failure to pursue treatment sufficiently to destroy all the parasites at the period of sporulation, so that the parasites thus escaping continue to pass through successive cycles of development until a group is produced of sufficient size to cause the toxic manifestations constituting a paroxysm. There are other instances, however, in which the relapse takes place a long time after the termination of the original paroxysm, and such instances have been ascribed to the persistence of some form of the parasite within some of the internal organs.

Anæmia.—In addition to the changes in the blood indicative of secondary anæmia of a grave type, in certain instances the alterations characteristic of

progressive pernicious anæmia occur; the termination of such cases is, of course, a fatal one.

Hepatic Sequelæ.—The malarial infection is undoubtedly the basis for hepatic changes in a certain number of cases. These changes have already been referred to, and as they are usually unaccompanied by clinical manifestations, further reference to them need not be made.

Nephritis. — Some involvement of the kidneys usually occurs in very grave malarial infection. Nephritis in its most intense forms is to be found in association with malarial hæmoglobinuria, and, as already stated, may then prove rapidly fatal. In ordinary cases, however, recovery ensues without permanent damage to the organs.

Amyloid Degeneration. — Amyloid degeneration is of infrequent occurrence as a sequel to malaria. Of the 145 cases of amyloid degeneration in the Collective Statistics of Fehr only 4 could be ascribed to malarial infection; and of 43 cases reported by Rosenheim only 4 followed this infection (Mannaberg).

Mental disturbances, disorders of the special senses, peripheral neuritis, cerebral and spinal paralyses may occur as post-malarial manifestations. As a rule, their tendency is toward complete recovery.

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Six cases of paralysis of the bladder occurring in the course of malarial affections. Patients were all men, and mostly those past middle life. Sometimes the paralysis came on in the course of malarial fever; in other instances it was the first symptom of malarial infection. Once it had appeared, it did not subside until the malarial trouble was entirely cured, and then it disappeared as suddenly as it had set in. Marion (N. Y. Med. Jour.; Medical Bull., Dec., '97).

Death caused by urinary suppression in malarial hematinuria in 90 per cent. of all cases. Vogel (Indian Lancet, Nov. 1, '97).

Two cases of aphasia due to malaria. The treatment and the result showed the correctness of diagnosis. Somapa S. Lingayet (Indian Lancet, Jan. 16, '97).

Retinal lesions found in the graver forms of malarial poisoning: swelled arteries and veins, perivascular œdema, and sometimes swelling of the papilla itself. In the blood of the retinal vessels were found the well-known changes in the red blood-corpuscles characteristic of malaria. Guarnieri (Arch. per la Sci. Med., No. 1, '97).

All malarial lesions of the eye originate in circulatory troubles. They are under the classified head: (1) neuritis; (2) retinal hæmorrhages; (3) retinochoroiditis; (4) effusions into the vitreous. Certain obscure affections noted are sudden and persistent amaurosis, without visible fundus-change, periodical amaurosis, sudden amaurosis ending in atrophy, persistent central scotoma, and periodical blue vision. T. M. Yarr (Brit. Med. Jour., Sept. 24, '98).

Diagnosis between quinine and malarial amblyopia can only be made by an examination of the fundus of the eye. By this method retinal alterations are found like those observed in patients suffering from malarial disease, or simply ischæmic troubles, as in cases of quinine intoxication. It is very rare that amaurosis due to malaria shows a tendency to remain and becomes permanent, while quinine amblyopia, even when it is not permanent, persists for a considerable time. Ischæmia of the disk constitutes the true pathognomonic sign of cinchonic intoxication. If nerve-atrophy is accompanied by marked contraction of the retinal vessels, and the ocular trouble has immediately followed the malarial manifestations which call for necessary energetic quinine medication, the patient is suffering from quinine amaurosis. Juan Santos (N. Y. Med. Jour., May 14, '98).

Prognosis.—The prognosis of malaria is influenced by a number of conditions the most important of which is the variety of parasite to which infection

may be due. Thus, the prognosis of ordinary quartan and tertian fevers when properly treated is almost always favorable, although even these milder forms of infection, if treatment be neglected or inefficiently carried out, may be followed by cachexia or anæmia of severe grade. As already mentioned, however, the tendency in these infections is toward spontaneous recovery. Æstivo-autumnal infections, on the other hand, show this tendency to a much less degree, and if left to themselves are much more likely to pass on into one of the grave post-malarial conditions, or to develop pernicious manifestations; nevertheless the prognosis of ordinary æstivo-autumnal fevers, when properly treated, is favorable, although it must be borne in mind that in this infection greater activity of treatment is demanded.

In the pernicious fevers the prognosis is always grave and can never be considered as favorable until that period of time has passed during which the occurrence of a second paroxysm is likely. These cases, of course, call for the greatest activity in treatment, and upon the efficiency with which this is carried out the prognosis largely depends.

The grave anæmias occurring as sequelæ of malaria are events which should cause the deepest concern regarding ultimate recovery; their course is only too apt to show progressive tendencies. The prognosis of chronic malarial cachexia depends largely upon the patient's ability and willingness to take advantage of changed climatic conditions.

Literature of '96-'97-'98.

Malaria is a disease that rarely kills in the large towns of the Atlantic sea-board. William Osler (Internat. Med. Mag., Jan., '96).

Five thousand and forty-four cases of malaria collected from the records of five hospitals in Philadelphia and it is found that there has been a decline in the number of cases during the last half century and more especially during the last twenty-five years. J. M. Anders (Univ. Med. Mag., May, '97).

Treatment.—In cinchona and its derivatives, more particularly quinine, we possess a remedy against malaria that may be regarded as a true specific. That quinine owes its efficacy in malaria to the destructive influence which it exerts upon the parasite is now agreed to by all observers. The changes in the parasite resulting from its administration have been given close study by Laveran, Golgi, Romanowsky, Marchiafava, Bignami, Mannaberg, and others. The action is most marked upon the young extracorpuscular bodies and very slight upon the parasite during the corpuscular phase of its existence. This is true not only of the parasites of the regularly intermittent group of fevers, but is also true of the parasite of æstivo-autumnal fever. It follows, therefore, that the administration of quinine a few hours before an expected paroxysm will not prevent its occurrence, because at the time of its administration the parasites being within the corpuscles are in that phase of their cycle of existence during which they are the least susceptible to the action of the drug. Segmentation is not prevented, therefore, and the paroxysm occurs, but the resulting free young segments are destroyed and their further evolution cut short, so that the next succeeding paroxysm is averted.

After the administration of quinine the active movements of the amœboid parasite, particularly of the tertian variety, are observed to lessen, while the pigment tends to clump and the parasite becomes more highly refractive. At the same time the parasites are much diminished in number and present the evi-

dences of degeneration, hydropic and fragmented forms prevailing.

The mode of administering quinine is to be regulated in accordance with the exigencies of the case. In the milder forms of infection its administration by the mouth is the preferable mode, while in cases of severe grade, where quick action of the specific is all-important, and in cases in which the drug induces vomiting, its hypodermic administration is demanded. By the mouth quinine is best given in solution, notwithstanding its bitter taste, as in this form only will its prompt absorption be absolutely assured. If given in capsule, or as the much-resorted-to quinine pill, at best the absorption of the drug is delayed and at the worst may be passed off by the bowel within the undissolved capsule or pill-coating. Under certain circumstances it may be deemed advisable to give quinine in the form of rectal enemata; this is the least certain of all the methods of administering the drug, however, and should only be employed when for some reason its administration by one of the other methods is contra-indicated.

Tablets of quinine frequently pass digestive tract without being absorbed; neutral tannate of quinine for prolonged use. Aufrecht (Ther. Monats., July, '95).

[I heartily concur with Aufrecht, that quinine should never be given in the form of tablets. The ordinary pill of quinine—especially when sugar-coated or gelatin-coated—I have frequently discovered in the alvine discharges *unchanged*. I consider the bichloride of quinine the best and most soluble form. It may be given in *freshly-made* gelatin capsules, but the cachets of the French—concave, paper-like disks made of rice-flour—are the best. Judson Daland, Assoc. Ed., Annual, '96.]

Literature of '96-'97-'98.

In children quinine bisulphate is more efficacious than the sulphate. Two grains are given as the child is years in age, or as many milligrammes ($^1/_{30}$ grain) as the child is months old. In children under two months, instead of internal use of quinine, friction with a pomade of 30 grains of quinine bisulphate to $1\,^1/_2$ ounces of axungum is ordered to be rubbed under the arms and in the groins. In nurslings of three to eight months three suppositories a day may be used, the dose of quinine being twice as great as by the mouth. If tenesmus of rectum is provoked, enemata of quinine—three a day—should be used. Feuchtwanger (Med. and Surg. Rep., Jan. 30, '97).

The choice of the particular salt of quinine to be given is a matter of some importance, as they are found to differ widely in the degree of their solubility and the percentage of the alkaloid which they contain. Although but very slightly soluble in water, the sulphate of quinine is the form most commonly employed. It is, however, readily soluble in acid solutions; so that when given in water it is customary to add sufficient sulphuric acid to effect its solution.

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Quinine is a specific for all forms of malarial infection. W. S. Thayer (N. Y. Med. Jour., Nov. 20, '97).

Fifteen grains of quinine with 15 grains of powdered ginger twice a day, and three doses of $^1/_2$ ounce of camphorated tincture of opium given in 47 cases of malaria. Twenty-two were cured at once, 5 within 24 hours; 10 within 48 hours, and 12 of the remaining 15 at later periods; 3 were not benefited. No relapse occurred in any case. The parasite found in most of these cases was of the æstivo-autumnal type. In 6 cases there was mixed infection with typhoid and malaria; 4 of these got well of the malaria during the course of the typhoid, and in 2 the malaria reappeared after convalescence from the typhoid fever. W. H. Thompson (Med. News, Dec. 17, '98).

Quinine is a poison to the plasmodium,

but is useless against the toxin manufactured by the latter. The destruction of hæmoglobin of red cells by malarial parasite aids in thermolysis, and this defect can be compensated by administering such remedies as tend to increase amount of hæmoglobin in blood, at same time combining with it such antiperiodic as quinine. L. H. Warner (N. Y. Med. Jour., Dec. 10, '98).

The susceptibility to quinine exhibited by some persons can be nearly always overcome by giving quinine with hydrobromic acid or the bromides—for example, twice as much bromide of sodium as quinine. Muriate of quinine favored instead of the sulphate. Andrew H. Smith (Med. Rec., Jan. 15, '98).

When administered hypodermically the neutral hydrochlorate of quinine is to be preferred on account of its greater solubility, 1 part being soluble in 0.66 parts of water. The following solution is recommended by de Beurmann and Villejean for this purpose:—

℞ Quinine dihydrochlorate, 75 grains.
Distilled water, enough to make 2 1/2 drachms.—M.

One cubic centimetre (15 minims) of this solution represents 0.50 (8 grains) of quinine dihydrochlorate. (Laveran.)

The intravenous injection of quinine has been advocated by Baccelli, but, as pointed out by Laveran, it should not be resorted to "except in the very severe pernicious paroxysms and when there is reason to fear that even the hypodermic method will not effect a sufficiently-rapid introduction of the salts of quinine into the blood." Baccelli recommends the following solution:—

℞ Quinine hydrochlorate, 15 grains.
Sodium chloride, 12 grains.
Distilled water, 2 1/2 fluidounces.
—M.

This solution is, of course, to be injected warm.

For certain pernicious forms of malaria the intravenous injection of a neutral salt of quinine should be given:—

℞ Quinine hydrochloratis, 15 grains.
Sodii chloridi, 1 grain.
Aquæ destill., 2 1/2 drachms.—M.

This may be injected into the veins in progressively-diminishing doses. Baccelli (Wiener med. Woch., Jan. 11, '90).

The administration of quinine should be so timed that the maximum influence of the drug shall be obtained at the time of the sporulation of the parasites, for the reason, as has just been said, that it exerts but little toxic influence upon the parasites as long as they remain within the blood-corpuscles. The drug is given, therefore, not with the hope of averting the pending paroxysm, but with the purpose of destroying the free young segments upon which the succeeding paroxysms will depend. In the fevers of the regularly intermittent variety this object is readily accomplished, and even small doses of the drug will frequently prove quite sufficient. It is well, however, to vary the dose somewhat in accordance with the severity of the case even in this type of fever; so that, while in the milder cases 2 grains given three times daily will prove effective in breaking up the paroxysms, in the cases of a somewhat more severe infection it may be well to give 5 grains three times daily. It is at times advisable in this latter class of cases to give a large dose of quinine at the expected time of the paroxysm, and, after having thus for several days prevented its occurrence, to continue the use of the drug in small doses three times daily for several weeks. It is claimed by Laveran that the type of fever should not cause any very marked variation in the manner of the administration of quinine, either as regards the dosage or the time of tak-

ing. Thus, for a male adult he advises the following practical directions: "On the 1st, 2d, and 3d days from 80 centigrammes to 1 gramme (12 to 15 grains) of quinine hydrochlorate daily in the course of twenty-four hours; on the 4th, 5th, 6th, and 7th days no quinine; on the 8th, 9th, and 10th days from 60 to 80 centigrammes (9 to 12 grains) of quinine hydrochlorate: from the 11th to the 14th day no quinine; on the 15th and 16th days from 60 to 80 centigrammes (9 to 12 grains) of quinine hydrochlorate: from the 17th to the 20th days no quinine: on the 21st and 22d days from 60 to 80 centigrammes (9 to 12 grains) of quinine hydrochlorate."

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Segmentation occurs at or about the time of the paroxysm: hence the quinine should be given shortly before it in order that it may be in solution in the blood when segmentation takes place. In this way a group of organisms may be almost entirely destroyed by a single dose. It is advisable to give a second dose just before the time at which the next paroxysm would occur. Fifteen or 20 grains may be given for the first dose and 10 grains for the second. J. L. Morse (Boston Med. and Surg. Jour., Jan. 16, '96).

In order to suppress attack of typical intermittent an adult is to be given 25 grains of quinine. In cases of masked malaria it may become necessary to increase the dose, even up to 50 grains. Quinine is to be given, at the very least, six hours before the ensuing attack. J. Ballagi (Indian Lancet, Dec. 16, '97).

In tropical malaria the usual blind administration of quinine at regular intervals is absolutely useless. Quinine does not kill the plasmodium: it merely checks its development. To produce the desired effect, it should be administered in the stage in the development of the plasmodium that precedes sporulation. Quinine at the right moment cures tropical malaria in its worst forms. R. Koch (Hot Springs Med. Jour., Aug., '98).

In the æstivo-autumnal fevers treatment should be more actively pursued and larger doses of quinine employed. Owing to the irregularity in time with which the parasites undergo segmentation quinine should be given irrespective of the occurrence of the paroxysm, so that its administration may be commenced in doses of 5 grains every four hours as soon as the case comes under observation. If the case be very severe and pernicious manifestations feared, several larger doses of the drug (15 grains) may be given at intervals of a few hours either hypodermically or by intravenous injection, while subsequently its use may be continued in smaller doses. If pernicious symptoms have already occurred, no chances that the drug may be absorbed through the stomach should be taken; it is imperative under these circumstances to administer it under those conditions most favorable to its rapid absorption; that is, by hypodermic or intravenous injection after the method of Baccelli.

Literature of '96-'97-'98.

In pernicious malaria cinchonism should be produced as rapidly as possible, and, since the temperature-variations are exceedingly irregular, large doses are necessary. The stomach will rarely accept the necessary doses, and hypodermic and intravenous injections (Baccelli's method) are to be considered. Great depression should be combated by strychnine and digitalis, and patient sustained by enemas of whisky, peptonized foods, and broths. Clarence J. Manly (Ther. Gaz., Dec., '97).

Notwithstanding the fact that quinine is held by some observers to be directly responsible for the hæmorrhagic phenomena characterizing malarial hæmoglobinuria, no particular modification of the treatment should be made in the management of these cases. In a gen-

eral way, the same treatment that is applicable to the other forms of pernicious fever is to be employed in malarial hæmoglobinuria.

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In treatment of hæmoglobinuria in malaria persulphate of iron and inhalations of oxygen are the most useful. If the malarial attack necessitates quinine its continuance is advised even in spite of hæmoglobinuria. Baccelli (Il Policlinico, Jan. 15, '97).

Quinine objected to in malarial hæmaturia, and following treatment recommended: 1. Sodium hyposulphite in drachm doses every two hours until the patient is thoroughly purged; continued in smaller doses until the system is saturated with it. Free sulphurous acid is disengaged in the blood, and this agent is an antizymotic to such an extent that it destroys the micro-organisms that are the real cause of the disease, and thus arrests the process of corpuscular disintegration. 2. Morphine and atropine hypodermically, sufficient to quiet the stomach: and blisters over the epigastrium, if necessary. 3. An abundance of water to wash out the coagula that must necessarily accumulate in the urinary tubules after a hæmorrhage. Hot water or hot lemonade is frequently better borne by the stomach than cold. Cupping over the loins is also to be recommended. 4. A mild diet; fresh buttermilk is usually well borne. 5. The patient should remain in a strictly recumbent position. Meek (Ther. Gaz., May 15, '97).

Quinine should not be given in malarial hæmaturia. The injudicious administration of quinine is often responsible for an hæmaturic attack. M. Goltman and William Krauss (Memphis Lancet, Dec., '98).

Tyson recommends quinine in malarial hæmaturia and believes that this symptom is due to another cause than quinine. Albert Woldert (Med. News, Apr. 30, '98).

Quinine acts nearly as a specific in all malarial fevers characterized by intermissions or well-marked remissions, but fails in continued fevers, those with typhoid-like symptoms, those malarial conditions without high temperature, and the cachexias and anæmias due to malaria.

Quinine should never be used in hæmoglobinuria, or given subsequently to one who has suffered from it. J. S. Van Marter, Jr. (N. C. Med. Jour.: Louisville Med. Monthly, Sept., '98).

In the management of chronic malarial cachexia much often depends upon the ability or willingness of the patient to remove to a non-malarious and healthy climate. Indeed, in some instances the adoption of such a course is absolutely necessary to effect a cure. At the same time quinine in small doses should be taken for a long time to destroy the parasites remaining in the blood and organs, and measures should be adopted to overcome the profound asthenia and anæmia. The indications of the former are usually fully met by the administration of bitter tonics and an abundant and nutritious diet, while the latter usually calls for the use of arsenic; indeed, in this condition a long-continued treatment with arsenic in ascending doses often proves most effective; not only is this remedy of value in the treatment of the anæmia incident to chronic malarial cachexia, but it is also to be employed in the same manner to combat the anæmia that is of such common occurrence during the convalescence from the acute forms of infection.

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Four cases of malarial cachexia treated with the spleen and bone-marrow of cattle, with apparently favorable results. Gritzmann (Allg. Wien. med. Zeit., June 30, '96).

Of 5 cases of malarial cachexia treated with hypodermic injections of citrate of iron, four cases recovered completely. The fifth was greatly improved. Naame (Rev. de Méd. de Paris, Mar. 10, '97).

Certain symptoms arising during the course of a malarial paroxysm may call for special treatment, but the indications to be met are only those to which general principles may be applied and hardly seem to call for particular mention.

Various substitutes for quinine in the treatment of malaria have been advocated, including the other derivatives of cinchona, methylene-blue, arsenic, strychnine, iodine, and a number of others. All of these, however, are far inferior to quinine in their antimalarial action, and, with the exception of arsenic under the conditions already mentioned, possess a very limited applicability.

In children hydrobromate of quinine of service in same doses as other salts of the alkaloid. Especially useful in nervous, excitable children. Solubility further promoted by association with antipyrine. Comby (La Méd. Mod., Aug. 28, '95).

Successful employment of methylene-blue. Seven and one-half grains were given six hours in advance of the time of the expected attack, and, subsequently, 1 ½ grains or more five times daily. Guttmann and Ehrlich (Wiener med. Woch., Oct. 24, '91).

Methylene-blue unsuccessfully employed in five cases, in hourly doses of 1.5 grains five or six times, as many hours in anticipation of the paroxysm. While it appeared to control the paroxysm, it did not prevent recurrence. Its use was also attended with irritability of the gastro-intestinal and genito-urinary tracts. Ketli (Ungarisches Archiv f. Med., B. 2, H. 1, '93).

Methylene-blue employed in thirty-five cases of intense malarial fever: the drug exercises an influence upon the plasmodia, as these were found to disappear and the paroxysms not to recur. The remedy was administered internally, or injected subcutaneously. The injections were given twice daily, 15 grains of from a 1-per-cent. to a 5-per-cent. solution of methylene-blue being used on each occasion. The paroxysms did not recur after from three to five injections had been given. By the mouth capsules containing 6 to 7.5 grains were given twice or thrice daily. Unpleasant symptoms, such as headache, anorexia, and vomiting, were in some cases observed to occur after internal administration. Porenski and Blatteis (Ther. Monats., Jan., '93).

Upward of forty cases in children treated with methylene-blue, with entirely satisfactory results. Dose employed varied from 4 to 7 ½ grains in the course of twenty-four hours, according to the age of the patient and the severity of the attack. The drug was of especial value in protracted and obstinate cases that resisted treatment by other means, and in cases of intermittent and remittent not sufficiently severe to be of immediate danger to life. In pernicious cases it would be judicious to join the subcutaneous injections of quinine bihydrochlorate. Its administration should be continued for several days after the subsidence of the fever and the disappearance of the other symptoms. It may be given in solution in syrup of orange-peel and syrup of canella. To larger children it may be administered in tablet, cachet, or capsule. Ferreira (Bull. Gén. de Thér., June 15, '93).

Living malarial parasites subjected, under the microscope, to the action of a solution of quinine 1 to 5000, and of a solution of methylene-blue 1 to 20,000. The former did not at all affect the movement of the plasmodia, not even after ten hours; the latter destroyed it very soon, and in about half an hour the microbes were stained a beautiful blue. H. Rosin (Schmidt's Jahrbücher, May 15, '94).

Of 2501 men on whom arsenic was tried, 579 were suffering from acute and 1384 from chronic malaria. The remaining 538 were free from the disease. In the acute cases arsenic was of little use, but it gave excellent results in the chronic cases, and in the others it seemed to confer immunity, or, if they contracted the affection, it was of a mild type and easily cured with quinine. The men put on flesh, and lost the pallid, cachectic look characteristic of dwellers in malarial regions. Daily administration of arsenous acid increases the resistance

of the organism to the action of the microbes of malaria. Ricchi (Brit. Med. Jour., Apr. 27, '89).

Phenocoll is as effective as quinine in malarial-fever state, whereas quinine, in many instances, gives rise to toxic symptoms. Phenocoll has not been found to give rise to such unpleasant effects. Phenocoll succeeds in a certain number of cases in which quinine absolutely fails. The taste of the drug can easily be masked by means of syrup, and is not objected to even by children. Dall (Gazzetta degli Osp., Jan. 14, '93).

Phenocoll should be substituted in pregnant women suffering from malaria, this drug having no action on the uterus; in doses of 22 grains divided in 4 cachets, to be taken 5, 4, 3, and 2 hours before a febrile paroxysm is due. Titone (Rif. Méd., Nov. 24, '94).

Nitrate of potassium very efficient in the treatment of chills and fever. Sixty-five per cent. of personal cases cured with a single dose; 35 per cent. were uninfluenced by repeated doses. Best results were obtained when the drug was administered during the premonitory stage, in anticipation of the paroxysm. Twenty-five or 30 grains at this period will abort the attack or modify its course and intensity. Hunter (N. C. Med. Jour., Mar., '90).

Sixty-one children were treated with helianthus, in the form either of an alcoholic tincture or of an alcoholic extract. Of the former, from $^1/_4$ to $2\,^1/_2$ drachms were given daily in divided doses in a potion, and, of the latter, from $^1/_4$ to $1\,^1/_2$ drachms. The remedy was well borne, even by the youngest infant. In the majority of cases the cure was as prompt as with quinine. Methylene-blue was administered to 36 children, varying in age from 23 days to 14 years. A cure was obtained in 10 cases, amelioration in 3, while in 14 the results were not conclusive. The drug was given in doses of from $3\,^1/_4$ to 6 grains in four equal parts, in the course of the day. The medicament was well borne and only in 1 case caused transient vesical tenesmus. Moncorvo (Le Bull. Méd., Jan. 15, '93).

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Analgen in doses of 4 to 15 grains in twenty-four hours used in 33 cases of malaria in children is a useful adjuvant to quinine, and a substitute when the latter cannot be administered. Moncorvo (Bull. de l'Acad. de Méd., Nov. 10, '96).

Guaiacol used in the treatment of malarial intermittent fevers: 15 minims were rubbed into the axilla and covered with cotton. The average fall of temperature in $^3/_4$ hour was 1.6°, in $1\,^3/_4$ hours, 2.3°, and after 4 hours the average fall was 3°. The fall of temperature was accompanied by a free perspiration and a marked improvement in the condition and comfort of the patient. No depression was noticed. Rogers (Ther. Gaz., May 15, '96; from Indian Med. Gaz., Jan., '96).

Fifteen-minim doses of creasote, rubbed into the axilla and then covered with cotton-wool, used in eight cases of severe intermittent fever with temperatures varying from 103.2° to 104.4° F., the temperature being either stationary or rising at the time the drug was applied. In every case perspiration, usually free, was produced in from half an hour to two hours, and was accompanied by a marked fall of temperature, averaging 1.6° F. within $^3/_4$ hour, 2.3° after $1\,^3/_4$ hours, and 3° within 4 hours after the use of the drug. At the same time all the distressing symptoms, including the severe headache always present with high fever in these cases, were decidedly relieved. Leonard Rogers (Brit. Med. Jour., Jan. 4, '96).

Roux's serum employed in 2 cases of quartan fever. In the first there were 2 subsequent rises of temperature and then complete cure. The second case, even after a second injection, showed no beneficial result. Treille (Sem. Méd. p. 312, '96).

Seven cases of malaria treated with methylene-blue in doses of $1\,^1/_2$ grains, in capsules, given six or eight times in the day. The rapid cessation of the attack was striking. Microscopical examination showed that the plasmodia disappeared from the blood later than the febrile attacks. Duration of the treatment extended over 8 days as a mini-

mum and 23 days as maximum. It was determined by the disappearance of the plasmodia and of the splenic enlargement. Rottger (Deut. med. Woch., Apr. 9, '96).

Methylene-blue should only be used in simple intermittent fevers, and it would be dangerous to substitute it for quinine in the treatment of continued fevers and in grave cases. It is only indicated, when, for some cause, the use of quinine is contra-indicated, especially when, even in small doses, it produces hæmoglobinuria. The daily dose in the adult is from 9 to 15 grains; sometimes it produces a slight cystitis that ceases when the drug is discontinued. Cardamatis (Gaz. des Hôp., Apr. 15, '97).

Phenocoll, though no substitute for quinine as an antiperiodic in impaludism, has valuable analgesic properties, and in small doses distributed over the twenty-four hours, or preferably administered from three to five hours before the access, alleviates the pains of the ague-fit and in certain cases refractory to quinine has even shortened its duration. However, Quirogne has found that, even in moderate doses, phenocoll has the disadvantage of causing symptoms of collapse. Editorial (Sem. Méd., No. 54, Nov. 17, '97).

Euchinin is superior to quinine in being tasteless and requiring a smaller dose to reduce temperature. It does cause cinchonism. In from 10- to 15-grain doses it is equal to quinine sulphate in 20- to 30-grain doses. St. George Gray (Post-grad., May, '98).

In those cases of malaria in which there is an idiosyncrasy to quinine, salicin and sodium salicylate are of great advantage. J. R. Gilbert (Jour. Amer. Med. Assoc., Nov. 12, '98).

Myrrh recommended, in the treatment of malaria, in the following formula: Quinine, 40 grains; pulverized myrrh, 20 grains; powdered licorice, 10 grains. Forty pills are made, one of which is to be taken every two hours. The myrrh increases the number of white blood-corpuscles, which are scavengers of the blood, and therefore more easily eliminate the malarial plasmodium. Aaron Jeffrey (Med. Rec., Aug. 20, '98).

There are cases of chronic intermittent fever, with large tumefaction of the spleen, that, after having resisted the action of quinine, arsenic, methylene-blue, eucalyptus, and piperine, are benefited by ergot. Jacobi (Med. News, Oct. 22, '98).

In the treatment of mild forms of malarial fever, while the preparations of bark may not act so rapidly as quinine, they are often more efficacious. After the paroxysms have once been arrested they are not so apt to recur. If the bark is given continuously for several weeks the patient's general condition is much better than it is in those cases in which quinine in small or moderate doses has been persistently taken. B. Robinson (Med. Rec., Jan. 15, '98).

Perfect cure in cases of undoubted malaria, which had proved intractable to quinine in large doses by small doses of nuclein (1 drop every two or three hours), which caused a prompt disappearance of the cachexia, migraine, gastro-intestinal disturbances, hæmaturia, general depression, and other so-called malarial symptoms under which the patients were suffering. Editorial (Cincinnati Lancet-Clinic, Apr. 30, '98).

Prophylaxis. — General measures of prophylaxis may be adopted in accordance with the facts known of the etiology of the infection and which have been referred to in the section on that subject. Although recent researches all tend to prove that infection occurs by other channels than the alimentary tract, notably the skin, it is the part of prudence to sterilize by boiling water coming from infected regions. The prophylactic value of quinine is not to be overlooked, and infection may often be prevented by taking the drug in doses of 6 grains, or even less, in the twenty-four hours.

To reduce, as much as possible, the quantity of the malarial ferment that enters into the system through the air breathed is sought to be achieved by avoiding agricultural operations during those hours at which the malarious influence is most potent, viz.: about sun-

rise and sunset. Another point of the greatest importance is to avoid breathing the air in close contact with the soil, as the malarious poison rises only a short distance in a vertical direction. It is advisable to keep the windows closed in the morning and during the early hours of the evening, especially if any excavation should be going on in the neighborhood. Flowers should be entirely excluded from houses when malaria is rife, or the utmost vigilance should be taken to secure thorough ventilation. Tommasi-Crudeli ("Climate of Rome and Roman Campagna," '92).

Valerianate of quinine as a prophylactic tried under strict surveillance in markedly malarious region. Of 30 soldiers 23 given the drug regularly; the 7 untreated suffered from fever, those treated remained entirely free. L. Cendero (Boletino de Méd. Naval, Aug., '95).

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Conclusions of a recent treatise on prophylaxis of malaria are: 1. To administer quinine in preventive doses, 12 to 15 grains, at intervals of four or five days, is considered sufficient. 2. As the germs are in the atmosphere and are breathed into the lungs, troops must be commanded to keep their mouths shut when marching, as breathing air filtered through the nose is much less dangerous. 3. Malarial districts, marshes, etc., must be avoided and habitations located 200 to 300 metres above them where possible. No work should be permitted in the heat of the day. Houses should be surrounded with trees at least their own height, and windows should be glazed to keep out the evening dew. Exposure to this dew must be strictly avoided as far as possible. 4. Europeans must not attempt to cultivate the ground in the intertropical regions. It is death to them, but does not injure negroes or other natives, who should be secured for this purpose. Maurel (Bull. Acad. de Méd., Jan. 21, '96).

Quinine usually proves very potent in preventing or at least mitigating malarial disease, even in very unhealthy localities. Three to 4 1/2 grains a day can be employed for months with impunity. The daily dose should not exceed 9 grains nor be less than 2 grains. Hydrochloride preferable to the sulphate and is better supported. If added to coffee, that precipitates a portion of the quinine. Laveran (Med. Record, Oct. 2, '97).

Prophylactic measures adopted in Central Africa: Certain amount of credit given to the exhibition of small daily doses of quinine, commenced at sea before entering the country and continued whenever the line of march lay along the course of low-banked rivers or cut across marshes or alluvial plains at a watershed-foot. The doses about 4 grains per diem, and were never pushed to the causation of symptoms. In Central Africa it was found after experience that the best clinical results were obtained by apportioning to each individual such an amount of the drug as sufficed to produce in him an aural disturbance indicative of the commencement of quininism. S. K. Smith (Lancet, Apr. 10, '97).

The administration of even small doses of quinine over a certain period acts injuriously on the red corpuscles, but clinical experience shows that in most cases the injurious effect of quinine, if not continued over too long a time, may be practically ignored. Most people can take 5 grains of quinine daily over a very considerable period without any appreciably injurious effect. For persons whose stay in malarial-stricken districts is brief, and where the malarial parasite is virulent, this dose might be increased. The prophylactic dose should be begun two days before the person is exposed to the action of malaria and to be continued for ten days after he leaves the district. Solution of the powder preferred to other forms. George Thin (Lancet, Jan. 25, '98).

Prophylaxis against tropical malarial fever in our camps should consist of changing the clothes before retiring at night, avoidance of constipation, and a daily ration of quinine, to which whisky should be added when the subject has been exposed to rain. Sleeping in shacks or in tents with the sides open, and as far as possible selecting for camps high sites exposed to wind and sunshine

should be encouraged. Hammocks should be swung at least three feet from the ground: in more permanent locations beds constructed of split limbs of trees are better than hammocks. Mosquito-nettings should always be used; and, as the mosquito of the tropics is often smaller than his fellow of the North, a very fine mesh is indispensable. To these precautions should be added a careful, systematic medical supervision of water-supplies, kitchens, and diet; a daily inspection of each company by a medical officer; and, finally, rejection at recruiting-stations of men with positive histories of malarial infection, and the invaliding home of all patients who respond only temporarily to treatment. J. E. Stubbert (Med. News, July 30, '98).

Review of the literature of the last twelve years, including the observations of explorers, army-surgeons, and others:

The following prophylactic measures, carried out simultaneously, are necessary in malarial districts to insure adequate protection:—

1. To avoid contamination through the respired air and inoculation by insects:—

Unacclimatized men, white or black, should not be employed for the digging of trenches, the erection of defenses, or any other kind of work involving upturning of the soil. Natives should alone be utilized for this work.

High ground should be selected for camp-sites, windward, if possible, of any swamp, pool, stream, etc., that may be in the neighborhood.

The men should sleep as high above the ground as possible (not less than two feet and, if practicable, from twelve to fifteen feet) and be provided with mosquito-netting.

While crossing malaria-laden forests, glens, lowlands, swamps, etc., the men should be ordered to avoid talking.

2. To avoid contamination by water:—

When water from malarial regions is alone available for drinking-purposes, it should be filtered, or, preferably, sterilized by boiling.

Bathing should not be permitted when water from a malarial region can alone be obtained, but washing of the body with such water is permissible, provided carbolic-acid soap be employed.

3. To prevent the development of malarial parasites in the blood:—

Four grains of hydrochlorate of quinine should be administered morning and evening *during* meals as prophylactic, beginning two days before the malarious region is reached.

4. To conserve the general powers of resistance of the economy:—

Regular and frequent periods of rest should intersperse long marches. Drenching and wading through streams should be avoided when possible. Varied and adequate food should be furnished.

The head should be so protected as to secure a maximum amount of coolness under all degrees of temperature, a head-gear such as the solar tepé being furnished for this purpose. C. E. de M. Sajous (Monthly Cyclo. of Pract. Med., May, '98).

As a protection against mosquitoes a piece of oak-punk about an inch square should be placed at bed-time in a saucer on a metal plate. Upon this is to be put a large pinch, about as big as a nut, of powdered pyrethrum, and when the mosquitoes get troublesome the punk should be ignited. The smoke produced by the burning pyrethrum will infallibly drive away the mosquitoes for the night. Editorial (Gaz. Hebdom. de Méd. et de Chir., June 23, '98).

James C. Wilson,
Thomas G. Ashton,
Philadelphia.

MALE FERN.—Male fern (aspidium, U. S. P.) is the rhizome of *Dryopteris filix mas* and of *Dryopteris marginalis* (nat. order *Filices*), ferns which are found in almost all parts of the globe, especially so the former; the latter is indigenous to North America. The rhizome, which deteriorates on keeping, has a sweetish-bitter, astringent taste, and a slight odor. It contains an active principle, filicic acid; a fixed oil, a volatile oil, resin, tannin, etc. The ethereal

extract deposits a yellowish-white, granular, crystalline substance (filicic acid), upon which the medicinal activity depends. The oleoresin is a thick, dark-brown fluid, of a bitter and nauseous taste: on standing, it deposits its active constituent, and must, therefore, be thoroughly mixed before being dispensed.

Preparations and Doses. — Aspidium (powdered crude drug), $^1/_2$ to $1\,^1/_2$ drachms.

Oleoresina aspidii, $^1/_2$ to 1 drachm.

Physiological Action. — The physiological effects of male fern are usually attributed to an amorphous acid, filicic acid; but the oleoresin is thought to contain all the virtues of the drug. Filicic acid first causes excitement of the nervous system, then paralysis of the latter, of the muscular system, and of the heart in the frog. This is mainly due to its depressing effects upon the spinal centres. In man its effects are probably similar, judging from the symptoms, following the injection of an overdose, mainly marked gastro-intestinal irritation, weakness, vertigo, tremors, cramps, amaurosis, stupor, and coma. Male fern is a vermifuge, *i.e.*, it expels the tape-worm, the entozoön against which it is generally employed.

Poisoning by Male Fern.—Toxic doses of the ethereal extract, or oleoresin, cause irritation of the gastro-intestinal tract, vomiting, purging, and great pain in the abdomen. If absorbed, it acts on the central nervous system and causes cramps in the extremities, giddiness, amaurosis, paralysis, collapse, coma, and death. Albuminuria and glycosuria are occasionally produced by overdoses of male fern. Poulssen, Katamaya, and Okamoto have found that castor-oil and other fixed oils increase the rapidity of absorption of the active principle. They should not, therefore, be used with, or after, filix mas. Six drachms have proved fatal in one adult, 12 drachms in another, and 2 drachms in a child $5\,^1/_2$ years old.

Literature of '96-'97-'98.

Study of the influence of male fern upon the blood and tissues of rabbits. There was a preliminary examination of each animal for several days, in order to determine the normal number of red cells, the proportion of hæmoglobin, and the weight of the body. The drug was administered through a sound passed into the œsophagus. As soon as the animal died the autopsy was performed, and fragments of the liver, spleen, bone-marrow, kidneys, and occasionally of the heart and central nervous system were hardened and subsequently sectioned. Of the eight animals experimented on, some were poisoned acutely with large doses, and others gradually with frequent small doses. In the acute cases the animals frequently died, and examination of their bodies failed to reveal any change that accounted for death. In the more chronic cases, considerable change in the constitution of the blood was not infrequently observed. This usually consisted in a diminution in the number of red cells and in the proportion of hæmoglobin, although the animals had lost a considerable portion of liquid, and consequently the blood was thickened. Morphological changes were not present. The glandular organs, the lungs, the heart, and the nervous system were apparently normal. The liver, the spleen, the bone-marrow, and occasionally the kidneys often contained a considerable excess of iron-pigment. The author is convinced that the liver is the organ in which the red cells are destroyed, and that the pigment deposited in it is subsequently conveyed by the circulation to the other organs. In his own observations, the granules of hæmosiderin appeared in the liver invariably one or two days earlier than in the spleen. The accumulation of the pigment in the liver does not appear to indicate that the liver-cells are incapable of getting rid of it, particularly on account of its extensive metastasis. Icterus did not occur in any

case, and there was no reason to believe that, aside from the increased activity of the liver-cells caused by their participation in the destruction of the erythrocytes, there was any injurious influence exerted upon the organ. Georgiewsky (Phila. Med. Jour., iii, p. 83, '98).

Treatment of Poisoning by Male Fern.—The poison should be removed by evacuants, avoiding the use of castor or other oils. Stimulants by mouth and by hypodermic injection are useful to combat depression and collapse.

Therapeutics. — Tape-worm. — Male fern is used almost exclusively as a remedy against tape-worm. It is seldom or never given in the crude form, or powder, but in the form of the oleoresin, or ethereal extract (non-official). The oleoresin, being nauseous in taste, is given best in capsules; it can be given in milk or gum-water, but is not as readily retained. A milk diet having been adhered to for a day or two, a purgative is given, followed by the oleoresin of male fern, and that in turn is followed by another purgative. The oleoresin given in divided doses, an hour apart, acts better in some cases.

Eczema.—Lanara has used male fern as an application in eczema:—

℞ Extract of male fern, alcoholic, 7 ½ drachms.
Alcohol, ½ ounce.
Extract of myrrh,
Extract of opium, of each, 1 drachm.—M.

Cysticercus. — Feletti has observed improvement in several cases of cysticercus disease following the use of the ethereal extract of male fern, more especially when the lesions were in the subcutaneous or muscular tissues.

MALIGNANT PUSTULE. See Anthrax.

MALT.—Malt is prepared from the seed of barley (*Hordeum distichum*, order *Graminaciæ*) by the process of artificial germination and subsequent desiccation. The barley-grains are soaked in water until soft. The water is then drained off and the grain is placed in suitable receptacles and subjected to an elevated temperature for several days. It is then placed in heaps, in a darkened room, where it is allowed to germinate until the plumule has grown to be half as long as the seed. The germination is then checked by the application of heat, which is maintained until it is perfectly dry, when it has become what is known as malt. If the last heat be a low one pale or amber malt results; if dark malt is desired the heat applied is higher and the malt may be almost roasted. The former varieties are used in medicine, the latter for making porter and dark beers. Malt has a sweet taste and an agreeable odor. In the process of malting the albumins are softened and made more spongy, the starch is changed by the action of the vegetable diastase, resident in the grain, with dextrin and maltose (malt-sugar).

Diastase, or maltine, is closely allied to ptyalin and to pancreatin. Their action upon starch is similar, if not identical. Raw starch is very slowly acted upon. On cooked starch it first produces a liquefying action, afterward converting it into dextrin and later into maltose. These ferments act best in a neutral medium. Its action is slow in an alkaline medium and is inhibited or even destroyed by the presence of an acid.

Malt is used by brewers to make beer, ale, and porter, and by distillers to make spirits. Malt enters into the combination of many foods designed for infants and invalids, of which Liebig's is the

type, either with or without the addition of milk.

Malt is usually employed in the form of the extract, which is made by mixing the malt with water at a moderate heat (under 160° F.). The mixture is left until all the starchy matter has been changed into dextrin and maltose, when it is evaporated in vacuum-pans to the consistency of thick honey. If the water is entirely extracted in the vacuum-apparatus, dry extract of malt is obtained, which is the form used in the preparation of foods for invalids and children. Another form of liquid malt (so-called diastasic extract of malt) is prepared by macerating well-malted barley in warm water for several hours; the infusion is then simmered with fresh hops at a temperature under 160° F., to retain the diastase and other albuminoids unimpaired, and then subjected to fermentation. The resultant liquid contains alcohol from a trace up to 10 per cent. It resembles porter or brown-stout in taste and appearance.

The ordinary extract of malt, resembling honey, is a good vehicle for cod-liver-oil, forming with it an excellent emulsion. It also serves as a vehicle for iron, quinine, the hypophosphites, pepsin, cascara, peptones, etc.

Physiological Action. — The claims that malt is a valuable reconstructive and digestant, though to a degree sustained by clinical observation, are not accounted for by what is thought to be its behavior in the stomach. The observations of Chittenden and Cummins would tend to demonstrate that the diastase — a ferment, formed during the germination of malt acid, is capable of converting nearly two thousand parts of starch into dextrin and glucose—is destroyed by the gastric juice. It must, therefore, be inert when the duodenum is reached. Again, the secretions being alkaline, any diastase not affected by the gastric juice would be hampered here, since it is known to act imperfectly in an alkaline medium. A neutral solution is required to obtain its best effects. That its physiological effects are still practically unknown is apparent.

Therapeutics.—Malt is a food-element, since it contains all the nutritive substances of malted barley and the ferment diastase which aids in the digestion of starchy foods. It is of pleasant taste and can be taken alone, on bread, or in milk. It may also be taken as a food in the form of an emulsion with an equal quantity of cod-liver-oil. It is useful in the wasting diseases, especially in marasmus and tuberculosis. Extract of malt is often retained when cod-liver-oil is not tolerated.

MALTA FEVER. See Malarial Fevers.

MAMMARY GLAND, DISEASES OF. —Under this heading will be considered the following subjects: Excessive secretion of milk, inflammatory disorders of the nipples, mastitis, and galactocele. Tumors of the breast will be reviewed under Tumors.

Agalactia, or insufficiency of milk-secretion, has been treated under that head in the first volume.

Galactorrhœa.—Galactorrhœa, or excessive secretion of milk, cannot be considered as a pathological condition, except when it is exhausting the strength of the patient, or when the profuse production of milk continues long after lactation has been suspended. The normal production in health approximates three pints in the twenty-four hours. Instances have been reported in which as much as seven quarts were secreted

daily (de Mussy). It is evident that such a degree of hypersecretion need not be reached before marked emaciation, anæmia, and even hectic symptoms appear. This is especially apt to be the case when loss of appetite attends the case—not an unusual feature.

Treatment.—The active production of milk should be as much as possible arrested, but not too suddenly. In mild cases suckling should be gradually abandoned, the infant being increasingly nourished with artificial foods, and tonics be administered to the patient. In the meantime the breasts should be supported by means of bandages.

> Overfilling of the glands is treated by restricted liquid diet, gentle saline laxatives, and firm compression by bandages over lower third of breasts. In caring for the breasts, patient's bowels should be kept open from the second day by small, repeated doses of compound licorice-powder, or pil. rhei comp. The nipple is washed in warm water before and after nursing and smeared with castor-oil. If the nipple becomes chapped or excoriated, the cracks are touched with 10-per-cent. nitrate-of-silver solution once a day. C. M. Wilson (Times and Register, Dec. 20, '91).

As soon as the child can be weaned, iodide of potassium can be employed in increasing doses, beginning with 5 grains three times a day.

Literature of '96-'97-'98.

> Effect of iodide of potassium tested on nursing women. From six observations it was found that the coming of the milk after labor is not delayed, that the course of the lactation is not interfered with, and that the infant does not suffer. G. Fieux (Rev. Obstét. Internat., May 1, '97).

Belladonna plasters so cut as to form shallow cones leaving an opening for the nipple are then applied over each breast, the latter being still supported with bandages. Belladonna ointment can be used instead if the glands are sensitive. As a tonic Mariani's coca-wine can advantageously be employed, a wineglassful being given between meals. Cocaine and mint have also been recommended, but the danger of cocaine habit should always be borne in mind.

> Antipyrine renders marked service in arresting the secretion of milk in newly-delivered women, provided the kidneys are normal. The drug is administered in 4-grain capsules, every two hours, for two days, or until 60 grains have been taken,—a quantity sufficient usually to produce the desired effect. Guibert (Lyon Méd., Aug. 9, '91).

Literature of '96-'97-'98.

Conclusions in regard to antipyrine in puerperal women are as follow:—

1. Antipyrine can be readily discovered in the milk.

2. Given in two doses of 15 grains each, at two-hour intervals, it was discovered in the milk five, six, and eight hours after ingestion, and in some cases as long as eighteen hours.

3. The drug was found to be excreted very slowly, and was always in very small amount in the milk.

4. It had no influence on the quality of milk.

5. It had no effect on the secretion of milk.

6. The infants showed no symptoms while the mothers were taking antipyrine, and they also rapidly gained weight.

It is certainly justifiable to use antipyrine in nursing women, more especially since it is of undoubted value in checking after-pains. Fieux (Archiv. Clin. de Bordeaux, Oct., '97).

When the accumulation of milk cannot be rapidly curtailed it should be drawn by means of a breast-reliever.

Disorders of the Nipples.—Although apparently trivial, these disorders are often the cause of great suffering to

nursing women, and therefore merit attention.

Defects of Development. — Short, depressed, and otherwise imperfectly-developed nipples — generally the result of corset-pressure—are frequently the seat of inflammatory disorders during a period of lactation and should be carefully watched.

> Out of 525 in childbed only one-half could suckle thoroughly in the first two weeks. The development of the nipple bore a direct relation to the value of the breast as a secretory organ. Wiedow (Centralb. f. Gynäk., No. 29, '95).

The undue suction to which they are necessarily submitted, the delicacy of the tissues, any abnormal condition of the milk, the augmented flow of saliva which the increased efforts of the infants induce, all tend to start a folliculitis. This soon develops into ulcerative fissures that become excruciatingly painful. They bleed easily and may cause, through the suffering induced, general and even mental disorders quite out of proportion to their cause. Small abscesses may follow and greatly compromise the value of the nipple: an efficient portion of the apparatus of lactation.

Treatment. — These complications should be anticipated. Some time before parturition the nipple should be manipulated daily, the aim being to bring blood to them and to increase their nutrition by gentle efforts to encourage their protrusion. Buccal or instrumental suction is recommended by many accoucheurs. They should be washed daily with a weak boric-acid solution and carefully dried. The manipulation gradually accustoms the nipple to mechanical irritation and by the time the infant is born they are better able to stand that involved in the suckling process.

Free use of alcohol as a wash for the nipples during the last month of pregnancy recommended. In case a fissure should develop a nipple-shield should be used, and if it persist the fissure should be thoroughly cauterized. Auvard (L'Union Méd., July 19, '88).

Depressed and useless nipples have been operated upon as follows:—

An assistant, with a pair of vulsella forceps, seizes the nipple and drags it out to a length somewhat greater than natural; the operator, with a pair of curved scissors, beginning, at a point about $^1/_3$ inch from the apex, excises a diamond-shaped piece of skin, extending out on the breast about $2\,^1/_2$ inches and about $^1/_2$ to $^3/_4$ inch broad at its centre. The fat is cleaned away down to the fascia, which protects the ducts from injury. Three such areas of denudation are made. Beginning in the denuded area, a catgut suture is passed in and out through the fascia, purse-string fashion, emerging at the point of entrance and encircling the base of the newly-designed nipple. This is now tied snugly, and, if properly passed, will hold the nipple out well after the vulsella has been removed. The denuded areas are now covered (as is the catgut suture and its knot) by drawing the skin of the diamond-shaped incision together with silk. A dressing is then applied so as to keep the breasts as much at rest as possible, when union by first intention is usually found to have occurred. Treatment must not cease with the withdrawal of the sutures, but the nipples must be protected by a suitable shield. Axford (Annals of Surg., Apr., '89).

Literature of '96-'97-'98.

Following method has proved successful in prevention of sore nipples:—

℞ Lanolin (Liebriech), 1 ounce.

Dispense in glass or porcelain screw-cap jar.

Sig.: For external use every night.

Patient begins its use from four to six weeks before the expected date of confinement and continues until delivery. Every night at bed-time a small portion of lanolin is thoroughly worked into each nipple with the thumb and fingers. In the morning it is removed by a soft nail-

brush which is well-soaked. The nipple should be brushed with lukewarm water and any mild, pure soap (preferably a white soap), giving it a thorough lathering for three or four minutes. It should afterward be rinsed with fresh water and dried as after ordinary bathing. J. Milton Mabbott (N. Y. Med. Jour., Sept. 10, '98).

Instrument for stimulating and irritating the mammæ employed with benefit. It consists of a large hollow hemisphere inclosing the entire breast, with an aspirating bulb. Every morning the instrument is applied and the breast aspirated. As soon as pain is felt the aspiration is stopped and the apparatus is left in place for twenty or thirty minutes.

This treatment is used in the following four classes of cases: (1) undeveloped breasts; (2) obstinate vomiting of pregnancy; (3) debility in young girls at the period of puberty; and (4) chlorosis. Dumas (Jour. de Méd. de Paris, 19, vi, '98).

Ulceration of the Nipple.—Erythema frequently occurs as a complication of lactation particularly in primiparæ. Far more distressing, however, is a condition due to the fact that the colostrum causes maceration of the epithelium of the nipple; small vesicles appear which, if not arrested by timely treatment, generally rupture. The erosions thus formed become covered with scabs, under which healing would normally occur; but, sucking being continued, the erosions are transformed into ulcerating fissures, which sometimes involve quite deep destruction of tissue. Occasionally the small vesicles, instead of being separated, become confluent, and, the entire epithelial covering of the nipple being compromised, a raspberry-like nipple results. These conditions are sometimes greatly aggravated by an unhealthy condition of the infant's mouth—which should always receive considerable attention when mammary disorders are present.

Fissures of the nipple are exceedingly painful, as already stated. They are most frequently met with at the apex and the base of nipple, where it meets the areola. In the latter case the suction of the child tends to tear them open, as it wears; hence the excruciating suffering induced. They usually appear the fourth day, but sometimes earlier, and quite marked febrile symptoms may be induced.

Treatment.—It is evident that the prevention here, first, of the primary irritation, and, if this is present, of the secondary manifestations, are indicated. Scrupulous cleanliness of the nipple will prevent accumulation of colostrum and the primary erosions; hence this should be insisted upon. Both nipples should be carefully washed with a weak boric-acid solution, not only after nursing, but immediately before, and they should be carefully dried.

[Great care must be taken during lactation to keep the child's mouth clean and the nipple carefully washed with some antiseptic. Should there be any evidence of a threatening mastitis nursing should cease at once. W. L. Richardson, Assoc. Ed., Annual, '89.]

When local lesions exist, suspension of lactation on the affected side causes them to disappear in a few days, provided adequate cleanliness is insured. When but one nipple is involved, therefore, it can be allowed to rest, the other being used for suckling. A breast-pump may be used to draw the milk from the disordered breast to avoid undue accumulation of milk. Buccal suction, by the nurse or the husband, was formerly recommended; but, the condition of the mouth being unknown, the breast-pump is to be preferred—if kept very clean.

Simple erosions usually yield promptly to hot water and laudanum, or Goulard's extract, the nipple being kept covered

with a light compress soaked in either of these solutions. At night carbolized ointment is preferable, to avoid adhesion of compress to the hard surfaces when the liquid has evaporated.

Excoriations of the nipple occasioned by nursing should be painted over by a solution of gutta-percha in chloroform. This application covers the excoriations with a film, which is not removed by the application of the child to the breast. Monti (Les Nouv. Rem., No. 4, '88).

Dermatol mixed with an equal quantity of castor-oil used in treatment of sore nipples. It is not necessary that the breast be thoroughly cleansed before the child receives its nourishment. P. Grossman (Omaha Clinic, Oct., '91).

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In erosions of the nipple the nipple should be washed with 4-per-cent. solution, after each nursing, then a layer of cotton dipped in the same solution is applied over it and the entire breast, and this is, in turn, covered with gutta-percha cloth. Dressing should be renewed frequently. If this fails, steresol should be applied to the affected part after drawing the lips of the fissure together: ten minutes later another coat of steresol to be applied. In fifteen minutes the child can take the breast, as the steresol forms an impermeable varnish. No dressing is necessary. Audebert (Arch. de Gyn. et de Tocol., May, '96).

Eczema of the nipples is sometimes taken for simple erosions, but it yields to the same measures. The salicylic-acid ointment is also of value.

When fissures are present, the same measures are indicated, but in addition stimulation by means of nitrate of silver is required. The nipple being washed and carefully dried, the mitigated stick, finely pointed, is gently applied to each fissue; the moisture within the latter affords precisely that needed to obtain the best effects from the remedy. Care should be taken not to touch the surface of the nipple.

In the treatment of fissured nipple, when the cracks are at all extensive, excellent results can be secured by the application of an ointment made up of equal parts of castor-oil and subnitrate of bismuth. Before application, the nipple and surrounding skin should be carefully cleansed and disinfected, and then the ointment should be smeared on plentifully. If it is necessary for the child to nurse from the affected nipple, it can be allowed to do so without the necessity of removing the ointment from the nipple.

For engorgement and pain in the mammary gland itself, which often accompanies fissured nipple, excellent results obtained from the use of an application of lead-water and laudanum, which is applied by means of a cloth covering the whole breast, renewed at frequent intervals and kept in place by a suitable mammary binder. If the child can be nursed from the other breast alone it is safer to draw the milk from the affected gland by means of a breast-pump until the cure is almost complete. If it is necessary that the child should nurse from the cracked nipple, a glass nipple-shield with a rubber tip must be employed. B. C. Hirst (Univ. Med. Mag., Mar., '91).

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Orthoform dressings successfully used in fissured breasts. The technique of the dressing is very simple. The powdered orthoform is dusted over the entire wound, and the latter is covered with a compress bearing a layer of the remedy. Over this is placed a layer of absorbent cotton, and finally rubber sheeting, the whole being kept in place by a bandage. In a few minutes the patient who has up to then felt incessant pains at the affected part, experiences considerable relief. Every time before nursing the child, the dressing is removed, the breast washed with warm boric-acid water, dried, and then the child put to the breast. At the first sucking some pains are felt, but these rapidly subside, and after the nursing is over, the breast is again washed with boric-acid water, dried, and the same orthoform dressing applied. The analgesic effect of the orthoform being very durable, it suffices

to renew the dressing at first twice daily, then, as the wound begins to cicatrize and the pains disappear, once only per day.

Besides its analgesic effect, orthoform exercises in the wound an action at once siccative and antiseptic, which favors cicatrization. In 29 cases personally treated, the cure was brought about in from four to five days on the average, the patients continuing to nurse the children. This method of treatment possesses the great advantage of being innocuous to both mother and child, because the orthoform is entirely free from any toxic property. Teisseire (Sem. Méd., xviii, p. ccxxvi).

When both nipples are affected, the infant should be given the breast as early as practicable, *i.e.*, as long as the mother can stand the pressure of the secretion. Prior to each nursing the nipple should be carefully washed and a nipple-shield employed to protect it. The infant sometimes shows evidence of ill-humor and refuses to suck through them: but a little patience usually controls the situation. A glass shield with an India-rubber tip is to be preferred. It should be kept scrupulously clean and washed immediately before and after using. If the infant refuses to use the tip, wetting the latter with sweetened water generally acts as an inducement. The remedial measures already indicated are then resorted to.

Mastitis.—Three forms of inflammation of the mammary gland are recognized: the *subcutaneous*, the *submammary*, and the *parenchymatous*.

Subcutaneous Inflammation.—This form is not frequently met with, and, though it may present itself in various parts of the organ, it usually confines itself to the areola. Its development is that of an ordinary boil; the spot first becomes red, warm, and extremely sensitive. When located in the areola, several small boil-like projections usually present themselves, which seldom do not proceed to the stage of suppuration. They sometimes assume an erysipelatous character.

Submammary Abscess. — The space between the gland proper and the pectoral muscle over which it lies is finished with a pad-like layer of connective tissue. Occasionally this becomes the seat of an abscess, and, when the suppuration is extensive, the breast is raised and may be moved from side to side. The local symptoms differ entirely from those of the former condition. There is but little redness, but the tissues at the base of the organs are œdematous, and the neighboring glands are generally enlarged and painful to the touch. There is a deep-seated, dull pain, radiating to the arm and often increased by the motions of the latter. There is marked fever, especially when the pus has formed, and lasting until the latter is evacuated. Pus usually points not far from the axilla, and when the abscess opens of its own accord a fistula may ensue. It may point in the direction of the lacteal ducts, a puriform fluid then being secreted with the milk.

Parenchymatous Abscess.—It was formerly believed that impediment to the escape of milk, through obstruction at the nipple, by stagnant milk, epithelium, etc., gave rise to this condition, but modern researches have shown that all forms of mammary abscess are of microbic origin. Micro-organisms originating from the infant's mouth or from hands contaminated with lochial discharge infect the nipple and readily reach the deeper parts directly or through the lymphatics.

Although tubercle in the human subject is so frequently met with in young married women, tubercular mammitis is extremely rare. S. Woodhead (Lancet, July 14, '88).

Case of patient of slightly tuberculous aspect who, on absenting herself from her infant seven and a half hours, found that her milk was horribly fœtid,—like rotten eggs. It made her feel ill, and her relatives could not stay in the same room with her. Yet the infant sucked with avidity; it was violently sick, however. Next day the milk was sweet, and the child and the mother were quite well. The breasts showed no sign of hardness, engorgement, etc. The nipples were healthy. On several previous occasions she had noticed that when she delayed giving the child the breast at the usual times the milk became fœtid. Jorissenne (Archives de Tocol., Feb., '91).

Case of mammary abscess which developed from infection from a lochial pad, which the patient took from the vulva and applied to the breast as a protection from cold. Tarnier (Jour. des Sages-femmes, Oct. 1, '91).

Every case of puerperal mastitis is now known to be due to infection. The bacteria find their way either through the milk-ducts or through abrasions or fissures of the nipple. The mastitis which has its origin through the milk-ducts is of a parenchymatous character, while that which arises from fissures or abrasions of the nipples is phlegmonous. The retention of milk within the breast is not, *per se*, a cause of mammary inflammation, but presence of bacteria will cause a decomposition of the milk thus retained, and then give rise to serious trouble. Olshausen (Deut. med. Woch., Apr. 5, '88).

In most carefully-kept wards there are septic germs which do not attain sufficient virulence to occasion serious puerperal accidents, but are capable of causing slight temporary febrile disturbances. Rémy (Revue Méd. de l'Est., Nov. 1, '94).

Verification of assertion previously made by Genoud, Etlinger, and others, that in the majority of cases the milk of perfectly-healthy nurses contained staphylococcus albus, which explains the ease with which local abscesses may be produced by pressure. Charrin (Revue des Sci. Méd. en France et à l'Etranger, Apr. 15, '95).

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Six cases of mastitis in one ward of the Strasburg Maternity, all occurring within seventeen days. In the pus from the second case there were found the staphylococcus pyogenes albus and the micrococcus tetragenus. This patient infected the third, fifth, and sixth cases, and as there was no direct contact, the infection must have been carried in the air. These women all infected their infants secondarily with aphthous stomatitis. The buccal secretion showed, along with leptothrix and streptococci, the staphylococcus pyogenes albus. A mouse inoculated therewith died in two days, and in its organs the staphylococcus was found. In the fourth case, a phthisical primipara, the mastitis was probably tubercular in nature, although no tubercle bacilli were found in the pus. In all the cases an abscess formed, and was treated surgically with success. H. W. Freund (Centralb. f. Gynäk., No. 41, '96).

Infective germs which gain access to the milk do so simply by circulating through the glands in the blood-stream. In order to enter the milk they must pass through the glandular substance of the breast through some injury to the gland-substance. Bach and Weliminsky (Berliner klin. Woch., No. 45, '97).

Breasts of 100 pregnant women, 137 puerperæ, and 60 children carefully examined, with the following results:—

In the majority of cases the secretions of the breast in pregnant and puerperal women and even in the newborn contain bacteria. In pregnant women this was true in 86 per cent. of patients examined, in puerperal women in 91 per cent., and in newborn infants in 75 per cent. With very few exceptions these germs were staphylococci, and especially the staphylococcus albus. In these cases no point of entry of these germs was found nor any circumstances explaining their presence. They must have entered from without through the nipples, and especially from the areola about the nipples. The presence of these germs was harmless to mother and child. The infection in mastitis comes from without, through a lesion in the skin communicating with the lymph-channels, and spreads itself in

different ways in the case of different germs. The ordinary form of mastitis results from invasion of staphylococci, especially the staphylococcus aureus. The less common forms of mastitis, such as pseudo-erysipelas and retromammary abscess, are caused by streptococci. Mastitis caused by metastatic infection through the blood-current has not as yet been clearly proved. Köstlin (Archiv f. Gynäk., B. 53, H. 2, '97).

The first sign is the presence of a hard mass in the tissues of the organ. At first no suffering is experienced, but pain is finally noticed while the infant is suckling. The presence of an abscess now becomes manifest. The hard mass previously noticed becomes very sensitive, the overlying skin red, resistant, hot, and œdematous, and the organ, as a whole, becomes heavy. The skin over the abscess finally becomes purplish and less tense, and fluctuation is soon obtained. When several foci of inflammation are present, they may suppurate successively, and the series of abscesses thus developed may destroy the entire gland, and the sufferings of the patient continue months. Septicæmia and gangrene sometimes complicate such cases. Even in the comparatively benign cases generally met with the general symptoms are sometimes quite marked.

Pathology.—In parenchymatous inflammation, according to Bumm, who carefully studied the question, the rapid proliferation of micro-organisms in the gland-structures causes fermentation of the milk, and transformation of its sugar into lactic and butyric acids. The casein becoming coagulated, the glandular structures become engorged with the coagula, and inflammatory changes soon follow. The periglandular tissues become infiltrated with bacteria and leucocytes, while the epithelial cells lining the glandular structures swell, desquamate, and disappear. Purulent miliary foci soon form in great numbers, and adjacent foci unite. Irregular cavities are thus formed and crossed by shreds of partially-destroyed tissues. In the walls of these cavities leucocytes accumulate, which stop the progress of the microbes, preventing farther spreading of the disintegrating process.

Treatment.—The treatment of subcutaneous inflammation does not always vary from that indicated for the nipple. When, notwithstanding preventive measures, the abscesses are formed, the pus must be evacuated. An important point in this connection is that any incision made should invariably radiate from the nipple,—*i.e.*, cutting away from the latter, toward the periphery of the breast, as the spokes of a wheel radiate from the hub. The milk-ducts are thus avoided, and a free incision can be made without danger, if it is necessary.

In submammary abscess the gland projects outward and seems to rest upon a pillow of fluid. The quantity of pus is sometimes very great,—over a pint,—the connective tissue yielding on all sides to form a large cavity or pocket. When the abscess does not point in any special direction, the presence of pus may be determined by means of an aspirator-needle inserted at the base, as if the organ were to be pierced. An incision can then be made near the lower border of the gland—the incision likewise radiating from the nipple. The pus being fully evacuated with antiseptic precautions, the abscess should be washed out with a 3-per-cent. solution of carbolic acid and drained with iodoform gauze.

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Method in treatment of abscess is as follows: As soon as elasticity and deep fluctuation are evident, an incision is made radiating from the nipple just large enough to admit the index finger of the

operator, and this is deepened until pus flows. The finger is now passed into the cavity and it will be brought fairly near the surface in a dependent position, and this is generally at the thoracic mammary junction. Sometimes the finger passes toward the axillary margin, and occasionally the cavity is so large that a stout bent probe must be used to indicate the deepest part of the abscess. In this situation, the gland being well raised by an assistant, a free opening is to be made, large enough to well evacuate the pus, and, the finger being now introduced through this, the inferior opening, the operator will find that the pus has burrowed about and is contained in loculi bounded by fibrous septa.

The cavity is well flushed out with an antiseptic solution, and a full-sized tube is introduced from below (this must be confined by a silk thread). The opening made near the nipple is closed with fine horsehair and painted with collodion.

The tube, a large one, can be left in the cavity as long as is needful, and is slowly shortened and withdrawn. The wound heals with a larger scar, but this is completely hidden by the position and volume of the gland above. Shields (Lancet; Boston Med. and Surg. Jour., June 11, '96).

In parenchymatous inflammation the infant must be weaned, otherwise the lesions will proceed from bad to worse. To avoid suffering due to milk-production the milk-pump should be used. In the early stage the abscesses can sometimes be stopped by the application of cold compresses constantly renewed. The old treatment is now discarded. It is important to support and immobilize the breast by means of bandages evenly applied.

Inflammation of nipple and breast should be regarded as a progressive rather than a self-limited disease, arising in most instances from septic infection of the nipple. Bandaging advisable after mastitis, still-birth, and whenever weaning is necessary on account of mammary disorders. Harris (Annals of Gyn. and Ped., Aug., '95).

Seventeen cases of mastitis treated successfully by evacuation of the breast, partly by sucking and partly by a sort of massage by which the breast is compressed and gently rubbed in the direction of the nipple. Kaarsberg (Hosp.-tid., p. 573, '95).

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Abortive treatment of threatened abscess consists in placing the cathode at some distant indifferent point and applying the anode as directly as possible to the seat of trouble. The current should be from 5 to 10 milliampères, and may be continued from three to five minutes. The anode should be large enough to almost cover the affected area. Applications may be made daily. Should, however, the abscess be already formed, the cathode is applied locally for its electrolytic effect, and the current must be a strong one, especially in old abscesses with a well-defined limiting wall. From 100 to 200 milliampères are required. The cathode may usually consist of a metal stem or rod lodged within the abscess. A. H. P. Leuf (Med. Council, Sept., '97).

Expression used in treatment of threatened abscess of the breast. Compression should be made daily from the circumference; in a few days the induration will subside. In no case has the method failed. W. B. Warde (Lancet, Jan. 3, '98).

Belladonna ointment, lead-water, and laudanum are recommended by various clinicians. Saline cathartics are useful as derivatives, provided the patient is not too weak.

When the presence of pus is ascertained, it should be evacuated under strict antiseptic precautions, an incision one-half inch in length, radiating from the nipple, being made in the most dependent portion of the organ. The cavity is then washed out with an antiseptic solution and drained.

The general health requires considerable attention, the strength of the pa-

tient bearing considerably upon the recovery. Good food, tonics, and pure air are important adjuvants.

Galactocele.—This condition is due to the distension or rupture of one or more lactiferous tubes. In the latter case the milk flows within the connective tissue of the gland.

Symptoms. — Two varieties of the rather rare condition are met with: in the one the accumulation of milk, within the duct or the connective tissue, occurs near the nipple and superficially. The appearance is typical, more or less large knob-like projections or swelling forming the apex of the gland. It usually appears suddenly while suckling the infant, when rupture of the tube occurs without causing much local distress. In simple dilatation the growth is gradual.

The second variety occurs in the substance of the organ, forming one or more irregular lobular projections, that are quite firm under pressure, especially in cases of long standing. In the latter, when due to rupture of the ducts, the accumulated secretion is often found hemmed in by a protective cyst-wall. When the duct is simply dilated, the wall is formed by the lactiferous tube itself. The former likewise appears more or less suddenly. In some cases the gland becomes very large, and as much as five quarts of milk have been withdrawn by means of the trocar.

Treatment.—Aspiration is sometimes sufficient to cure small cysts; but, in the majority of cases, it is best to open the distension antiseptically and to drain.

MANDRAKE. See Podophyllum.

MANGANESE. — Manganese (manganum) is a very hard brittle metal, having a metallic lustre, and a whitish-gray, metallic fracture. In the metallic state it is not used in medicine.

Manganese dioxide (peroxide or binoxide), or black oxide of manganese (mangani dioxidum, U. S. P.), is found native, containing at least 66 per cent. of pure dioxide. It occurs as a heavy, black powder, and is soluble in hot mineral acids. Dose, 2 to 15 grains.

Manganese sulphate (mangani sulphas, U. S. P.) occurs in transparent pale-rose effervescent prisms having a bitterish, astringent taste, and is soluble in 0.8 parts of water. Dose, 5 to 15 grains.

Potassium permanganate (potassii permanganas, U. S. P.) occurs in dark-purple, slender, opaque prisms, having a blue, metallic reflection, and a sweet, with astringent after- taste, and is soluble in 16 parts of cold water and 3 parts of boiling water. Permanganate of potash is incompatible with all oxidizable substances, particularly organic ones. Dose, $^1/_2$ to 3 grains.

The liquor ferri mangani peptonate (non-official) is very generally used. Dose, 1 to 4 drachms.

Physiological Action. — The physiological action of manganese is not established. Once thought to be a chalybeate equal to iron, it failed to sustain the reputation, and is rarely employed by the profession in the treatment of anæmia and chlorosis. Especially has it been ostracized since Gahn demonstrated that there was considerable doubt as to whether it entered the circulation at all, while there was nothing to show that it was taken up by the blood-corpuscles.

Poisoning by Manganese. — Acute Poisoning.—In toxic doses manganese causes intense gastro-enteric inflammation and death by convulsions. In smaller doses it lowers the action of the heart, diminishes the pulse-rate, and lessens the blood-pressure.

Chronic Poisoning. — Absorbed in large doses and for a considerable period

it acts as a cumulative poison, induces acute fatty degeneration of the liver, a progressive wasting and feebleness, a staggering gait, and paralysis (paraplegia). This latter variety is the one seen among the miners of the metal.

Therapeutics. — Menstrual Disorders.—Manganese dioxide has been used extensively in the treatment of disorders of the uterine functions, especially when due to a functional cause. It has been used in membranous dysmenorrhœa in doses of 2 grains, in pill or capsule, given four or five times daily. In amenorrhœa, of acute suppression of the menses from cold, and when the menstrual discharge is scanty and irregular, manganese is of good service.

Some 200 cases treated with permanganate of potash. It was found of service in dysmenorrhœa in otherwise healthy girls, in excessive subinvolution after childbirth, in atrophy during puerperal affections, and in pelvic peritonitis after labor. The remedy proved of little avail in affections of the tubes and ovaries in which the gonococcus was found, and in atrophic conditions of the uterus from early appearance of the menopause. Lvoff (Med. News, May 19, '88).

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Binoxide of manganese used for many years for functional derangements of the uterus with a smaller percentage of failures than from any other drug.

In the absence of organic disease it seems to have the power, in a great many cases, of bringing the menstrual function back to the normal standard in whatever direction the deviation from that standard may have been.

In painful menstruation beginning about four days before the expected period, and continuing until the flow is fully established, it will generally give a measure of relief.

The headache of a burning character, and limited to the vertex, which so frequently has a uterine origin, is often promptly relieved by two or three doses of the drug, administered at intervals of two or three hours.

It also gives decided relief to the hot flashes attending the menopause, if the patient takes a pill of 2 grains at bedtime.

The dose is 2 grains three times a day, but as it is absolutely without unpleasant effects, it may be given in much larger quantity and at much shorter intervals. For its effect upon the periods it should be given for three or four days before the expected time and continued nearly or quite through the period, this being repeated for several consecutive months. A. H. Smith (Ga. Jour. of Med. and Surg., Jan., '98).

Anæmia and Chlorosis.—In anæmia and chlorosis manganese is beneficial, but only when combined with iron. Gude's liquor mangani-ferri peptonatus is a very palatable and efficient preparation for the purpose. It has an agreeable, astringent, but non-metallic taste, and may be given in the dose of a dessertspoonful to a tablespoonful three or four times daily, alone or in milk. This preparation increases the appetite, does not disorder digestion, and can be taken steadily for a long period.

Scrofula.—In scrofula and debility due to prolonged suppuration the non-official syrup of the iodide of iron and manganese is a remedy of great value.

Gastric Disorders.—In gastrodynia and pyrosis, the dioxide, in doses of 10 to 15 grains, is recommended by Leared.

Jaundice. — Malarial jaundice has been relieved by the sulphate of manganese in doses of 2 grains. The sulphate, however, has an irritating effect on the bowel, and is unsafe.

Rheumatism. — The internal administration of potassium permanganate has been advised for the treatment of acute articular rheumatism, diphtheria, and

diabetes. Its usefulness in the diseases is doubtful.

Antidote to Morphine, Phosphorus and Snake-bite.—H. William Moor, of New York, has shown that potash permanganate is a direct chemical antidote for morphine, but is without effect on atropine, cocaine, veratrine, pilocarpine, aconitine, and strychnine. An equal quantity, grain for grain, of permanganate is antidotal to morphine. In cases of poisoning by opium, laudanum, or the uncombined alkaloid, he advises acidulation of the antidotal solution with dilute sulphuric acid, or white-wine vinegar, in order that the insoluble morphine may be converted into a soluble salt. (See Opium.)

Hagnos, of Budapest, has found the permanganate a reliable antidote in phosphorus poisoning. After washing out the stomach he introduces a pint of a $^1/_{10}$-per-cent. solution and allows it to remain. If applied immediately after the receipt of the wound it is efficacious in snake-bite poisoning.

External Uses.—Externally the permanganate has a wide field of usefulness. Applied as a wash or on compresses of gauze or lint, in the strength of 2 to 10 grains to the ounce of water, it is a valuable deodorizer and disinfectant for sloughing wounds, cancerous growths, ulcers, gangrene, and caries. Dilute solutions have a stimulant action on the tissues and favor granulation and healing. It may be used as a spray in ozæna or as a mouth-wash or spray in diphtheria, scarlatina, and conditions causing foul breath.

> Upward of 300 cases of toothache from dental caries successfully treated by administering $^1/_{20}$ solution of permanganate of potash in the form of a mouth-wash. One tablespoonful was taken into the mouth every half-hour, and held on the affected side for several minutes. The agonizing pain disappeared in a few hours. Popoff (Russkaia Med., No. 19, '87).

Sponging the feet with permanganate solution will remove the odor of abnormal perspiration. In purulent ophthalmia permanganate solutions (1 to 2000 or 1 to 5000) have been found useful. A 2- to 5-per-cent. solution has been used with benefit in leucorrhœa. In a 1- to 2-per-cent. solution it finds favor as an injection for gonorrhœa.

Permanganate solutions should not be injected into gunshot wounds of the abdomen, or into abscesses connected with the peritoneal cavity, as they are sometimes irritating or even caustic. Glycerin should not be added to permanganate solutions, as it is incompatible, and forms a violent explosive.

C. Sumner Witherstine,
Philadelphia.

MANIA. See Insanity.

MANIA A POTU. See Alcoholism.

MASTITIS. See Mammary Gland.

MASTOID DISEASE. See Cerebral Abscess, External Ear, and Internal Ear.

MEASLES.—From an old English word meaning a spot.

Definition.—Measles—morbilli or rubeola—is an acute, infectious, contagious disease generally met with in children.

Symptoms.—Measles runs a less variable course, as a rule, than does scarlet fever and some other infectious diseases. Very mild cases sometimes occur, however, while the disease occasionally runs a very severe course. In rare instances a malignant type is encountered. Among 115 cases Carr found the average dura-

tion of the disease when uncomplicated to be twenty-six days from the prodromal symptoms to the end of desquamation. The period of incubation of measles is about twelve days.

Measles usually begins gradually, with feverishness, sneezing, coryza, suffusion of the eyes, and photophobia. Occasionally a chill followed by a high temperature is the initial symptom. Within twenty-four hours after the advent of the first symptoms a cough of peculiarly hard dry character appears and the attack presents all the symptoms of a catarrhal cold. The coryza, however, is more marked than that of an ordinary cold. The fever often falls somewhat after the first day; a fact which may throw the physician off his guard. The coryza and cough, however, do not correspondingly diminish with the fall of the temperature, but usually increase. The eruption appears on the side of the face and is usually first seen on the afternoon of the fourth day and is accompanied by increased fever. The eruption may appear as early as the second day, particularly in young children, and is, in rare instances, delayed to the fifth or sixth day. Drowsiness is not uncommon during the stages of invasion, but there are no characteristic constitutional symptoms.

During the stage of invasion and before the anatomical changes are noticed on the surface of the body an eruption will be found upon the velum palati, which constitutes the surest sign of the affection. Tyler (Amer. Jour. of Obstetries, Aug., '88).

The initial fever, or catarrhal stage, varies to an equal extent with the incubation period; out of 193 cases in which this was noted, 12 had no premonitory symptoms, the rash being the first sign of illness; 41 were affected only one day, 29 two days, 55 three days, 35 four days, and 21 from five days to a week before the eruption appeared. In one case there was a period of three days of giddiness, with a subnormal temperature, followed by a measles-rash. J. G. Carstairs (Australian Med. Jour., July 15, '93).

Measles give rise to a mild pultaceo-erythematous stomatitis: this may precede exanthem, always accompanies it, and disappears with it. It is insidious and latent, and serves as means of diagnosis in doubtful cases (measles or rubeola). Comby (Le Bull. Méd., Nov. 24, '95).

Literature of '96-'97-'98.

Measles may have a premonitory rash These eruptions vary in character, being scarlatiniform, morbilliform, and erysipelatous. They may even resemble red miliaria. The erythemata generally appear about the second day of the period of invasion, and disappear before the measles eruption. Robet (Jour. de Méd., Sept. 10, '96).

Koplik has recently described a symptom which he believes to be of great value in making an early diagnosis of measles. On the first day of invasion he has found that an examination of the buccal mucous membrane in a good light will reveal a scattered eruption consisting of small, irregular spots of bright-red color, in the centre of each of which is a minute bluish-white speck. This he regarded as pathognomonic of measles. Carr and other writers have recently expressed a belief in this symptom.

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Diagnostic importance of the bluish-white spots upon the mucosa of the cheeks, signalized by Koplik as a constant phenomenon of the period of incubation, confirmed by the examination of 50 morbillous patients. Libman (Med. Rec., June 11, '98).

Koplik's spots found 45 times in 52 cases of measles, and in another epidemic 31 times in 32 cases. A good illumination is necessary to make the spots visible. The spots scarcely ever coalesce, and the rash can easily be differentiated from

other affections of the mucous membrane. It somewhat resembles thrush, but is distinguished from this by the color and the roundish shape of the eruption. They cannot be wiped off, but the whitish spots can be removed with forceps without giving rise to pain or bleeding. Microscopically examined, they consist of thick layers of buccal epithelium, partly fatty degenerated. Koplik's spots were seen in measles only; they were absent in nine cases of rubeola. Slawyk (Deut. med. Woch., No. 17, '98).

The temperature will occasionally be found at 103° or 104° on the first day, but it is usually not above 102°. The fever does not ordinarily range as high in measles as in scarlet fever. Not infrequently after a sharp rise on the first day the temperature falls on the two following days, but increases as the eruption appears and reaches its height on the second day of the eruption. From that time it gradually falls, and becomes normal between the seventh and ninth days of the disease. Not infrequently there is a sudden fall on the sixth or seventh day, forming almost a crisis. The fall of the temperature after the initial rise on the first day is sometimes so decided as to lead to error in diagnosis. The possibility of such a fall is always to be considered. The fever and other constitutional symptoms are usually at their height when the eruption has reached its fullest development on the fifth or sixth day of the disease.

In a number of cases of measles complete absence of fever noticed. Montefusco (Revue Mens. des Mal. de l'Enfance, Aug., '88).

In measles the temperature does not keep up quite so long as the eruption lasts, in this point differing from scarlet fever. J. T. Whittaker (Ohio Med. Jour., Nov., '93).

Case of hyperpyrexia in measles, occurring in an infant 19 months old. The temperature reached 109° F. and remained there for an hour and a half; then it gradually stopped. The child died on the following day. J. J. Brachio (Indian Med. Rec., June, '92).

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Case of a child of 16 months who developed a temperature of 107° F. during the premonitory symptoms of measles. Four days later the temperature suddenly rose to 110° F. Stimulation with the application of a modified cold pack brought the temperature down to 97° in three-quarters of an hour; convulsions followed, occurring several times during the next 12 hours; subsequently, the condition improved and the child gradually recovered. R. H. A. Hunter (Brit. Med. Jour., Apr. 30, '98).

The rash usually appears on the afternoon of the fourth day, but in some cases is seen on the third day and in others is delayed until the fifth day. It is first seen on the temples and sides of the face, on the neck, or behind the ears. When it first appears it commonly consists of small red spots having no strictly characteristic appearance. They rapidly increase in size and form small macules or very slightly elevated papules on a slightly-reddened base with normal skin between. They are circular or crescentic in shape, and, being hyperæmic in nature, disappear on pressure.

As the eruption develops it tends to become confluent in places, particularly on the face, where it assumes a blotched appearance. There is usually a certain amount of œdema, particularly about the cheeks and eyes, which farther tends to change the appearance of the patient. The eruption usually reaches its height at its first site of appearance at the end of thirty-six hours; it remains stationary for about two days, and then rapidly fades away. It extends over the body somewhat slowly, appearing on the trunk and limbs on the second day.

The wrists and backs of the hands are

commonly the points to be last involved. When at its height in these places, the rash is sometimes partially faded on the face and neck. On the first day the spots form simple macules, but later they become flat papules that can be readily felt by the finger and are sometimes almost shotty to the touch. The rash commonly presents its most typical appearance on the chest.

The typical rash of measles is frequently accompanied by miliary vesicles and in rare cases petechiæ appear. Occasionally the rash, instead of assuming the usually hyperæmic form, becomes distinctly hæmorrhagic. This may occur in limited areas or may extend over the whole body. In the latter case it presents the type known as "black measles," a condition extremely rare in private practice. It indicates a severe form of the disease, but is not as generally fatal as is popularly supposed. The spread of the eruption is sometimes extremely rapid, the whole body being covered in a few hours, but this is rare. In other rare instances the rash is so slight and of such short duration as to be almost overlooked. The constitutional symptoms in such cases are, as a rule, correspondingly mild. Occasionally in malignant cases, marked by sudden and severe initial symptoms, the rash scarcely makes its appearance or is greatly delayed.

No disease is like measles save rötheln; and this can be easily distinguished, if the severity of the catarrhal symptoms, the nature of the cough, the appearances of the fauces, and the high febrile movement at the height of the eruption be recognized. Tyler (American Jour. of Obstet., Aug., '88).

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All causes which can provoke an obstruction of the local or general cutaneous circulation may produce an ecchymotic form of morbillous eruption. Diseases of the larynx associated with dyspnœa, and especially whooping-cough, may be mentioned as the chief of these. Albert Rouger (Thèse de Paris, '96).

Enanthem described as characteristic of German measles. This is a macular, distinctly rose-red eruption upon the velum of the palate, the uvula, extending to but not on to the hard palate. These spots are arranged irregularly, not crescentically, are the size of large pinheads, and are very little elevated above the level of the mucous membrane. It is very short lived and fades away within the first twenty-four hours. It is the same eruption found upon the skin. Forchheimer (Pediatrics, July 1, '98).

The constitutional symptoms reach their height during the stage of eruption, being usually at a maximum on the sixth day of the disease. They then remain stationary for about two days, when the fever abates and all the symptoms begin to subside. This sometimes occurs so suddenly on the sixth or seventh day as to form a crisis. This, however, is not the rule.

During the height of the disease the patient presents a very characteristic appearance. The face is covered by a patchy eruption and is swelled and œdematous; the eyes are red and sensitive to the light and are filled with a mucus or muco-purulent secretion; the nose is swelled and discharges a similar secretion; there is a dry, metallic, and very troublesome cough; the tongue is coated; the appetite is completely lost; the bowels are frequently relaxed; the child lies in a heavy and stupid condition, but is restless and irritable when disturbed. The glands at the angle of the jaw are frequently enlarged, and not infrequently the post-cervical glands, also.

As the fever subsides the cough rapidly changes its character, becoming looser and less irritating. It frequently disap-

pears within a week, but sometimes the evidences of bronchitis continue, and the cough proves a troublesome symptom for several weeks. In most cases the photophobia subsides rapidly, but the eyes are prone to remain weak and watery. If strong light is admitted too soon a mild, but very troublesome and persistent, form of conjunctivitis may result. Other symptoms usually subside rapidly; the child becomes brighter and less irritable; the appetite returns, and evidences of illness soon disappear.

Desquamation. — Desquamation begins as soon as the eruption has faded, and follows the order of its appearance. It rarely continues more than ten days in any given area, and may be of much shorter duration. It is most intense where the eruption has been most intense. It occurs in fine branny scales quite unlike the lamellar desquamation of scarlet fever. It is often so slight as to be completely overlooked, particularly when inunctions of the skin have been carefully used. Desquamation is usually completed in from twenty to twenty-four days after the onset of the disease.

Irregular Forms.—Measles is capable of assuming very irregular and atypical forms. Such irregular types are most common in children under three years. Nevertheless, in a given number of cases a much larger proportion of measles cases will run a typical or regular course than will a similar number of cases of scarlet fever.

In an epidemic of 423 cases, only 123 were of the regular type: 103 were of the malignant type, complicated with some other disease, and furnished 7 of the fatal cases. The remaining 200 cases were of the hæmorrhagic form. The only symptoms present in absolutely all the cases, of whatever type, were rise of temperature and eruption. The catarrhal symptoms were entirely absent in about 5 per cent. of the cases. The mouth-rashes of Guersant and Blache and of Girard were present in only about 25 per cent. C. J. Edgar (Canada Med. Rec., Dec., '92).

Mild Type.—The disease may be extremely mild, the eruption being faint, the fever slight, and all the symptoms mild. Such cases present no variation from the usual type except that of mildness in degree. Although the catarrhal symptoms may be slight, the diagnosis of *morbilli sine catarrho* should be made with extreme hesitation.

Case of atypical measles in which there was sudden onset, absence of coryza, erythematous sore throat, and scarlatiniform eruption. J. C. Wilson (Med. and Surg. Reporter, Jan. 17, '91).

Case of measles in which all catarrhal symptoms were absent. J. B. Harris (Lancet, Feb. 21, '91).

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Case of a girl who had measles for the first time at eight years, and a second attack two years later.

In the first attack the skin was severely affected, but the catarrhal symptoms were extremely mild. In the second attack the throat symptoms were severe and characteristic, but the exanthem did not appear until two or perhaps three days after the usual time, as indicated by the other symptoms, was imperfectly developed, and soon faded. Gottstein (Münch. med. Woch., No. 13, '96).

Severe Type.—A severe form is sometimes seen, marked by unusually high temperature, intense eruption, and severity of all the symptoms. Except in young children, the uncomplicated disease, even when of severe type, is rarely fatal. But it should not be forgotten that a temperature that reaches an unusually high point or continues unabated as the eruption fades is usually due to some complication, commonly pulmonary. Any marked variation from the

usual type demands particular attention, for it commonly indicates a complication.

Malignant Type. — Malignant measles, marked by intense and overwhelming symptoms from the outset, is fortunately rare outside of institutions. The same is true of hæmorrhagic, or black, measles.

Case of malignant measles in an adult, simulating typhus fever, purpura fulminans, cerebro-spinal fever, and variola. J. C. Wilson (N. Y. Med. Jour., Aug. 4, '94).

Rubeola tropica is a specific eruptive fever, the primary rose-red rash appearing on the face and neck on the second day of the illness; the second rash, miliary and papular, on the body, face, and occasionally on the limbs, on the fourth day. The third rash—of small, coalescent wheals—appears on the arms and legs, or legs only, on the sixth day, when the fever subsides. The more severe form of the disease chiefly attacks adults. It is epidemic, contagious, but seldom associated with catarrh or desquamation, and characterized by the intensity of the pains in the back, head, and orbit, on the third and fourth days of the illness. The period of incubation is, in ascertained cases, under seven days. For three days after the disappearance of the rash the patient can eat but little, and is so weak that he feels disinclined to attempt to walk. Soreness is experienced in the back and sides, but the headache and pain in the orbit are gone, although giddiness is complained of. A marked symptom in all is complete absence of taste. A further sequel is a subcutaneous hæmorrhage from the capillaries of the legs. James Cantlie (Lancet, June 25, '92).

Relapse in measles is extremely rare and is, in fact, of doubtful occurrence. A secondary rise in temperature after a normal fall indicates a complication.

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Eleven cases of measles with relapses were seen in two epidemics at about the same time. From the two series of cases it would appear that overcrowding was more probably the cause of relapse than increased virulence of the germ. A. Chautfard and G. H. Lemoine (Bull. Méd., Jan. 1, S. '96).

Two clear cases of recurrence in measles seen. Sévestre (Bull. Méd., Jan. 1, S. '96).

Of more than 700 cases of measles, not a single case of recurrence or relapse seen. Comby (Bull. Méd., Jan. 1, S. '96).

Etiology.—Measles is doubtless due to bacterial action, but no specific microorganism has yet been isolated.

Priority claimed in the discovery of the measles bacillus, prepared specimens of them having been shown as early as May, 1878, at a meeting of the London Pathological Society. P. Murray Braidwood (Lancet, Apr. 30, '92).

Bacillus considered the specific organism of measles discovered in fourteen cases of the disease, in the blood as well as in the sputum, and the nasal and conjunctival secretions.

It is very variable in size, sometimes as long as one-half the diameter of a red blood-corpuscle, sometimes quite small, with the appearance of diplococci. Canon and Pielicke (Brit. Med. Jour., Apr. 23, '92).

Blood in 24 severe cases of measles examined according to the method detailed by Canon and Pielicke, with entirely negative results. Albert Josias (La Méd. Mod., June 2, '92).

Bacillus personally observed as existing in the blood in measles. The bacilli in the blood vary in length from one-half micromillimetre to the diameter of a red blood corpuscle, and in cultures grow into long threads. They stain well with all the aniline dyes, and in the longer forms a part of the protoplasm often remains unstained. They lose their stain by Gram's method. They grow best in bouillon or sterile serous fluid from the abdominal cavity, in which a whitish, fairly heavy sediment is formed, which in older cultures becomes yellowish-gray. The cultures have no characteristic odor. Rabbits were always immune to the bacteria. Mice died from septicæmia three to four days after inocula-

tion with small quantities of the culture, the bacilli being obtained again in pure cultures from the liver and spleen.

The bacillus believed to be the specific cause of measles. Joseph Czajkowski (Centralb. f. Bakt. u. Parasit., Nos. 17 and 18, '95).

The vitality of the germ is evidently small, though it must be extremely diffusible, for measles is the most contagious of the infectious diseases, except smallpox. Its occurrence is uncommon under six months, but above that age every child who has not already had it may be expected to contract it upon exposure.

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Case of infant born on the day when the mother exhibited the morbillary rash, and at the time of birth had nasal catarrh, conjunctivitis, and cough. When three days old the eruption was out over the whole body, the temperature was raised, and the whole clinical picture of measles was presented. Recovery occurred after the lapse of six days. A. Bartsch (Ugeskrift for Laeger, No. 48, '96).

Case of measles in an infant, eruption appearing thirteen days after delivery. Possible infection at birth. Carstairs Douglas (Brit. Med. Jour., May 7, '98).

Case of infant seized one week after birth with measles. Other children in the house had been suffering from the disease, and it is believed that infection occurred at birth. F. C. Fitz-Gerald (Brit. Med. Jour., Oct. 1, '98).

Adults are rather more susceptible to it than to the other infectious diseases. Measles is endemic in all large towns, but at intervals it becomes epidemic and spreads over a wide area before it expends itself. Sex is not a predisposing factor.

Sources of Infection.—Measles is transmitted by direct contact, but the area of contagion is large. Although intermediate contagion may occur, it is comparatively rare. The infectious power of the poison is quickly lost, so that sick-rooms very soon become safe for occupancy.

The following conclusions deduced from study of three distinct epidemics of measles: 1. Measles are spread by actual contact with the *materies morbi*. 2. A case in the stage of incubation may inoculate those who are unprotected. 3. It cannot be carried by a protected person coming from a case of the disease to a susceptible person. 4. It does not spread through the atmosphere. 5. Strict quarantine will prevent it. V. M. Reichard (Therap. Gaz., July 16, '88).

Following conclusions bear on the incubation and contagiousness of measles: 1. The germ of rubeola does not remain in a locality from which those who have suffered from the disease have gone away. Hence, disinfection of the bed and furniture is unnecessary. 2. Contagion is always direct, from person to person. 3. Incubation is shorter in the intense than in the mild forms. It usually lasts from 12 to 18 days, but may last 21 days. 4. The power of the contagion is such that in a favorable medium it attacks all who are susceptible to it. 5. Contagion is possible 3 or 4 days before an eruption is evident. 6. Broncho-pneumonia is a secondary additional infection, but may co-exist with the rubeola and manifest a mixed infection. Bard (Revue d'Hygiène et de Police Sanitaire, May 20, '91).

It is possible that contagium may be conveyed by the breath; but it is certain that it resides in the sputa and the discharges from the nose and eyes.

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The nasal fossæ and the throats of monkeys touched with mucus obtained from children with measles in the first or second day of the eruption. Three out of eight animals presented local and general symptoms resembling those seen in human measles. Josias (La Semaine Méd., Mar. 9, '98).

If the contagion resides in the desquamation scales, it is far less potent than is the poison carried by the desqua-

mation of scarlet fever. The disease may be conveyed by clothing or it may be contracted by a susceptible person entering a room recently left by a measles patient.

There is no law of periodicity in measles epidemics. The measles contagion must have its origin in some kind of clothing which has been worn by, or has come into contact with, an infective person. The spread of measles appears to be influenced by the time of year; the number diminishes with the approach of warm weather. Möller (Archiv f. Kinderh., vol. xxi).

Incubation.—The period of incubation ranges from 9 to 21 days. Holt found it to be between 11 and 14 days in 66 per cent. of 144 carefully-observed cases. I have repeatedly seen the initial symptoms appear 12 days after exposure. From all the evidence available it would seem that 12 days is the most common period of incubation.

The incubation period varies from 8 to 9 days to 15 and 16 days in different cases. Measles are extremely contagious before the rash appears. J. J. Eyre (Brit. Med. Jour., Feb. 23, '89).

Case of measles in which the period of incubation was 27 days. P. Trekaki (Paris Méd. vol. xiv, No. 49, '89).

In several hundred cases of measles the period of incubation was found to be from twelve to eighteen days. J. G. Carstairs (The Scalpel, July 15, '93).

Incubation of measles is almost uniformerly thirteen or fourteen days. W. F. Lockwood (Archives of Pediatrics, June, '93).

Infection.—Measles may be contagious from the first appearance of the catarrhal symptoms, authentic cases being recorded in which the disease was transmitted four days before the eruption appeared. It is most contagious, however, when the disease is at its height. The contagiousness diminishes as the active symptoms subside, and is slight during the stage of desquamation. Except in complicated cases, in which the catarrhal symptoms are usually prolonged, the period of infection is not over twenty-eight days.

Rubeola is very contagious during the period of invasion; continues to be so, but at a less degree, during the eruptive period; and ceases at its termination. Transmission is usually effected by the circumambient air. Contagion by a visitor or by objects which the patient touches is rare. Sevestre (Le Prog. Méd., Mar. 2, '89).

Pathology.—In uncomplicated measles the lesions are confined to the skin and the mucous membranes of the conjunctivæ, nose, pharynx, larynx, and the larger bronchial tubes. The morbid changes of the skin are those of acute hyperæmia; on the mucous membranes they are those of acute catarrh. In complicated cases pseudomembranous inflammation may occur. Death rarely results from the simple disease, but rather from the complications, which will be considered later. The complications are due to mixed infection, the germ most commonly present being the staphylococcus. The streptococcus is, however, frequently present, and, as a rule, causes more serious lesions than those of the staphylococcus. The mucous membranes are rendered very susceptible by measles to these germs. As they are invariably present in the wards of hospitals, the disease in such institutions is always a dreaded one, for it is prone to be complicated.

In post-mortem examinations of patients dying from measles, a general infection by streptococci found. Le Dantec (Gaz. Hebdom. des Sci. Méd. de Bordeaux, June 19, '92).

Attention called to manifestation of subacute septicæmic infection in very young children. It is attributed to infection by streptococci. V. Hutinel and Paul Claisse (Revue de Méd., May 10, '93).

Case in which a varioliform eruption developed in a case recovering from an attack of measles. An eruption having same structure as pustules of variola may occur without involvement of epidermis, but simply through presence of bacteria in the capillaries of papillary body; thrombosis of vessels of the skin may occur without hæmorrhage. Unna (Univ. Med. Jour., Oct., '95).

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Case of gangrene of the lung in measles. In the gangrenous focus there were found streptococci, a bacillus resembling the Klebs-Lœffler bacillus, and bacilli resembling morphologically the streptothrix and a large, putrefactive germ. Méry and Lorrain (Soc. Anat. de Paris, Mar., '97).

Complications and Sequelæ. — The most common and serious complications of measles are broncho-pneumonia, membranous laryngitis, and otitis; the most common sequelæ are tuberculosis and conjunctivitis.

Bronchial catarrh is an essential part of measles, but it is very easy for the inflammation to extend from the smaller bronchi to the alveoli, thus transforming a normal condition into a most serious complication, — namely, broncho-pneumonia. The younger the child, the greater is this danger. It occurs chiefly in children under three years, and is comparatively rare in children over four years. It is very common in institutions and renders measles the most dreaded of all epidemic diseases in infant hospitals, diphtheria being no exception to the rule. In a recent epidemic of measles in the Infants' Hospital of New York every case in children under eighteen months was complicated by broncho-pneumonia or croup, and 80 per cent. died. The pneumonia usually made its appearance soon after the eruption reached its height, but developed in a few cases during the stage of invasion, the disease being regarded in two instances as simple broncho-pneumonia until the eruption suddenly appeared. According to Holt, 10 per cent. of all cases are complicated by broncho-pneumonia. He agrees with Henoch that a certain amount of pneumonia is found at autopsy in almost every fatal case. Carr found it clinically twenty-one times among one hundred and fifteen hospital patients.

The pneumococcus and streptococcus are met with in the saliva of children suffering from measles with much greater frequency than is the case in health. Broncho-pulmonary complications in the course of measles only occur, with but rare exceptions, in children in whom the saliva contains the pneumococcus and streptococcus; therefore, during the progress of a case of measles the most rigorous attention should be paid to buccal antisepsis. H. Méry and P. Boulloche (Revue Men. des Mal. de l'Enfance, Apr., '91).

Infectious erythema following the eruption of measles (two to sixteen days), generally observed in cases complicated with purulent bronchitis or broncho-pneumonia with infection by streptococci. When associated with broncho-pneumonia, death very rapid. Mussy (Jour. de Méd. et de Chir. prat., Apr. 10, '93).

Four cases of measles complicated with muco-sanguineous diarrhœa. Children in same ward and almost simultaneously attacked; all died presenting symptoms of broncho-pneumonia. At autopsy, ulcerations of sigmoid flexure and rectum analogous to those of true dysentery. Meslay and Jolly (Revue Men. des Mal. de l'Enfance, Aug., '95).

Lobar pneumonia is an occasional complication of measles in children over four years, but is seldom if ever found under three years. Empyema is sometimes a sequel of such complicating lobar pneumonia. The signs and rational symptoms of either form of pneumonia com-

plicating measles present nothing unusual.

Case of subcutaneous emphysema complicating measles in the absence of any violent cough or any known injury. S. W. Kelley (Therap. Gaz., Jan., '91).

Emphysema of the subcutaneous tissue in case of a child, 2 1/2 years of age, who had suffered from measles for six weeks, with much coughing. Felsenthal (Archiv f. Kinderh., B. 14, H. 1, 2, '91).

Catarrhal pharyngitis is an essential part of measles; pseudomembranous pharyngitis sometimes occurs as a complication. Instead of invading the nose and ears, as in scarlet fever, it shows a strong tendency to invade the larynx; but croup frequently develops without the appearance of membrane in the pharynx.

Six cases of croup with alarming stenosis, 2 cases of dyspnœa of pulmonary origin, 1 case of broncho-pneumonia with pyothorax, 3 cases of acute delirium during convalescence from measles (all three in adults), and 1 case of polyuria with retention for twenty-two days (without paraplegia), all noted as complications of measles. H. Audéoud and M. Jaccard (Revue Méd. de la Suisse Rom., Jan. 20, '94).

Laryngeal cough, due to punctate spots and shallow ulcers in the air-passages, is very common in measles. The symptoms suggest croup. A. Brothers (Jour. of Laryng., May, '93).

As in scarlet fever, the pseudomembranes which develop during the height of the attack are usually due to streptococci, and are, therefore, not true diphtheria. Those which develop later are usually due to Klebs-Loeffler bacilli and are true diphtheria. This secondary streptococcic disease, however, is quite as fatal as the bacillary disease. Not only is the child in imminent danger from laryngeal complications, but it is almost certain, also, to develop broncho-pneumonia, which occurs as the direct result of streptococcic infection. The differential diagnosis between true and false diphtheria can rarely be made with certainty from clinical appearances alone. Fortunately, in private practice both complications are rare in children over four years.

Rapidly-fatal so-called pseudodiphtheria may supervene in measles without affording any certain diagnostic clinical sign. W. F. Lockwood (Archives of Pediatrics, June, '93).

Klebs-Loeffler bacilli in the throats of ten out of twenty-eight cases of measles. None, save one case requiring intubation, showed any sequelæ or further manifestations of diphtheria. R. S. Adams (Med. Rec., Sept. 29, '94).

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Case of association of measles and diphtheria in the same subject. M. Poulet (N. Y. Med. Jour., June 5, '97).

Otitis, while less common than in scarlet fever, sometimes occurs, but does not usually prove so serious. Both ears are usually involved, but the disease presents in its symptoms and course nothing worthy of particular mention.

Alterations found in the labyrinth in measles which pertain to the lymphatics and the blood-vessels. In the former the lymph coagulates and the cells accumulate; they also fill up the semicircular canals and the cochlea. The endothelium undergoes fatty degeneration. In the blood-vessels the destruction is nearly complete in the Haversian canals and in the spiral ligament. The muscles undergo waxy degeneration. The nerves become gelatinous and, at places, entirely atrophied. The cells of Corti's membrane are also similarly degenerated. Notwithstanding the intensity of these lesions and the frequency of auditory complications in measles, permanent deafness is a rare sequence. Moos (Amer. Jour. Med. Sci., July, '88).

Tympanic involvement was due in 26.1 per cent. of cases to measles. The otitis media is due, not so much to direct extension of inflammation from the throat

and nose, by the Eustachian tube, to the middle ear, as by the sealing or plugging of the mouth of the Eustachian tube by the retained mucus in the naso-pharynx, the damming, then, of mucus in the ear, with consequent distension, extravasation, and pain in the ear.—all favored by the recumbent position. Downie (Brit. Med. Jour., Nov. 24, '94).

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The inflammatory process in the middle ear in measles usually runs its course without subjective and often without objective symptoms, and only now and then leads to spontaneous perforation of the membrana. The ears in measles should therefore be carefully watched. A. O. Pfingst (Pediatrics, Feb. 1, '98).

Complete anorexia is common during the febrile stage. Diarrhœa is of frequent occurrence and may be so severe as to prove a serious complication. It may be due to simple intestinal indigestion, or it may be the evidence of enterocolitis. It is occasionally so severe as to prove a serious complication.

Febrile albuminuria is not infrequent in cases with high temperature, but nephritis is very rare.

Fatal case of uræmia sequent to measles. S. Zichy-Woinarski (Australasian Med. Gaz., Oct. 15, '93).

Nervous symptoms, excepting the occasional appearance of convulsions at the outset, are rare.

Paralysis following measles is more frequent in the female than the male, and more frequent in children than in adults. Bayle (Revue de Ther. Medico-Chir., Mar. 1, '88).

Paralysis due to measles is not as rare as is commonly believed. There are two forms, the spinal and cerebral. P. A. Lop (Centralb. f. klin. Med., No. 50, '93).

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Case of ascending myelitis complicating measles. Ellison (Lancet, Oct. 17, '96).

Two cases of mania during measles. Finkelstein (Wratch, No. 20, '98).

Case of mania due to intestinal septic absorption, occurring on the eighth day of an attack of measles. A. K. Bond (Maryland Med. Jour., Jan. 29, '98).

Endocarditis and pericarditis are seen in rare cases.

Meningitis may occur as a further complication, through the presence of otitis.

Case of spinal meningitis complicating measles, followed by recovery. The cranial nerves and brain were unaffected. Starck (Jahrb. f. Kinderh. u. phys. Erzieh., vol. xlvii).

Cellulitis and suppurative adenitis are uncommon, but moderate enlargement of the cervical glands often occurs and sometimes persists for months.

The occurrence of measles simultaneously with other infectious diseases is not very infrequent. There seems to be a particular tendency to the simultaneous occurrence of measles and pertussis.

Pertussis as a complication of measles noted 21 times in 166 cases. E. P. Bernardy (Annals of Gyn. and Ped., July, '94).

Case of concurrent measles and scarlet fever. The germs of the measles must have been in the system of the child at the time that it developed scarlatina. C. H. Phillips (Brit. Med. Jour., Dec. 20, '90).

Case of measles and scarlatina co-existent in the same child at the same time. A. A. Himowich (Med. Rec., Sept. 7, '95).

Case in which measles co-existed with chicken-pox. F. W. Joshua (Lancet, July 13, '89).

Case of concurrent enteric fever and measles. Juhel-Renoy (Le Bull. Méd., Mar. 12, '93).

Case in which typhus and measles occurred in a patient at the same time. J. Tenner (Amer. Medico-Surg. Bull., Aug. 15, '94).

Two cases of urticaria seen during the incubative stage of measles. Of 270 cases

of measles, croup was present in 17 cases, and in 3 cases diphtheria. Claus (Jahrb. f. Kinderh. u. phys. Erzieh., June 5, '94).

Case in which erysipelas co-existed with measles. Measles exerted arresting influence upon erysipelas, which, in turn, was also favorably influenced by morbid process. Janovski (Med. Obozrenije, vol. xliv, No. 15, '95).

Tuberculosis is the most serious sequel of measles. It commonly occurs as a tubercular broncho-pneumonia, general miliary tuberculosis, tubercular adenitis, or tubercular joint disease. These conditions may result from primary infection or from the lighting up of some old tubercular process. Measles unquestionably renders the tissues very susceptible to tubercular bacilli; so that infection may result from slight exposure. Acute miliary tuberculosis may follow measles at once, the temperature-range being continuous from the outset of the primary disease to death from the complication. General tuberculosis with grave pulmonary involvement may follow so close upon measles as to leave no appreciable interval between. It is sometimes the cause of a secondary fever, which develops soon after the subsidence of the primary fever. Tubercular disease of the bones and joints subsequent to measles is usually of late occurrence.

Case of disseminated cutaneous tuberculosis consecutive to measles. Du Castel (Bull. de la Soc. Fran. de Derm. et de Syph., vi, p. 86, '95).

Literature of '96-'97-'98.

Tuberculosis follows measles with remarkable frequency. J. A. Larrabee (Pediatrics, Oct. 1, '97).

Chronic conjunctivitis is a frequent sequel of measles which may be in large degree prevented by judicious care. Iritis and keratitis are possible sequels, but are not common.

Literature of '96-'97-'98.

Case of bilateral ophthalmoplegia and right hemiplegia following measles. Raymond (Gaz. Heb. de Méd. et Chir., Jan. 5, '96).

Prognosis.—Death from measles in private practice is rare in children over four years of age. Holt, after the study of a large number of cases, concludes that the mortality of the disease is from 4 to 6 per cent., but under two years it is often 20 per cent. or more. It is highest between one and two years, but even at this age uncomplicated measles is not a highly-fatal disease. Pneumonia is the cause of death in almost 90 per cent. of fatal cases.

A violent onset with high temperature warrants a guarded prognosis. A rising temperature with a fading eruption warrants an unfavorable prognosis. The same is true when the eruption is excessive in amount and confluent over wide areas. Grave general symptoms with faint eruption is a serious condition. The same is true of an hæmorrhagic or black eruption, but it is not as necessarily fatal as is commonly supposed.

Literature of '96-'97-'98.

The mortality from measles at the Hôpital Trousseau in 1895 was 14.4 per cent.; 715 children were admitted. Comby (Lancet, Mar. 21, '96).

The death-rate from measles during the last twenty years shows that there are two maxima, one in December and a higher one in May and June. The death-rate has diminished during the last ten years. The highest mortality is found among infants during the first year. A rickety chest with the accompanying broncho-pneumonia doubles the mortality. Möller (Archiv f. Kinderh., vol. xxi, '97).

Measles has a marked tendency to leave behind it results of a serious nature. Treatment should not be directed solely

to saving the life of the child nor should the prognosis be made up solely with reference to that event. The tendency to tubercular invasion should never be forgotten, and when the fever persists after the tenth day, even if it is not high, the prognosis should be guarded. The list of chronic affections left in the wake of measles is a long one: bronchitis, pharyngitis, rhinitis, adenoid growths, enlarged tonsils, and mesenteric glands are among the number which should receive consideration.

Prophylaxis. — The advisability of taking particular precautions against the exposure of infants is suggested by the high mortality of measles before three years. Delicate children of the so-called scrofulous type and those with hereditary tendency to tuberculosis should be especially guarded against exposure. Early and absolute isolation of the sick is imperative. Quarantine of the patient should not be less than twenty-eight days and as much longer as purulent discharges may continue. The period of quarantine after exposure should not be less than fifteen days and twenty days is preferable. Children who have been exposed should be isolated from other children for that period.

The sick-room is less liable to prove dangerous than is the scarlet-fever sick-room. Thorough cleansing and ventilation for two weeks after the patient has left it is sufficient to insure safety. The infection of measles is not persistent nor is intermediate infection common; so that prolonged precautions are not necessary. During the height of the disease the same measures should be taken to avoid the exposure of others as in other infectious diseases.

Excellent influence of the closure of schools in an epidemic of measles; schools were closed for a period of four weeks, and only 4 cases appeared among 20,000 scholars after the schools were reopened. Wolford (Sanitary Record, May, '89).

As a prophylactic measure, the disinfection of the nasal fossæ, the mouth, pharynx, genitals and anus advised. J. Comby (La Méd. Mod., Jan. 6, '94).

Literature of '96-'97-'98.

In order to avoid the broncho-pulmonary complications of measles it is necessary to realize as much as possible the asepsis of rubeolous patients and to disinfect the quarters in which such patients are cared for. Hutinel (Méd. Infant., July 1, '97).

Treatment.—The patient should be placed in as large and well ventilated room as possible. The temperature should not be kept at too high a point nor should the child be forced to swelter under too heavy covering. It accomplishes no good and renders the child restless and irritable. The room should be kept very dark and no direct light should be permitted to fall upon the eyes. As the inflammation of the eyes subsides, the light should be gradually admitted, but full light should not be permitted until the conjunctivæ have become normal in appearance. Itching of the lids should be relieved by cold cloths or by the application of cold cream or some bland oil. If a purulent discharge appears the eyes should be kept clean by a frequent application of a solution of boric acid.

When troublesome pulmonary symptoms are present and severe inflammation of the eyes, fluid extract of eucalyptus, in 5-drop doses. For eyes, solution of mercuric chloride (1 to 12,000), a drop or two instilled twice daily and followed by washing with solution of borax in warm water. Wells (Phila. Polyclinic, July 13, '95).

The child should be put to bed, even in the mildest cases, and kept there until

desquamation is practically completed. The diet should consist of milk and broth during the febrile stage; during the height of the disease the child should not be overurged to eat.

Applications of plain or carbolized vaselin do much to reduce the irritability of the skin. As soon as the eruption begins to subside, inunctions of plain or carbolized vaselin or ichthyol ointment should be practiced daily. A daily warm bath does much to hasten desquamation.

Literature of '96-'97-'98.

Over three hundred personally treated, with a mortality of only four. This low rate of mortality attributed to the method of treatment invariably adopted, namely: jacket poultices, to be changed as soon as any indications of measles show themselves and before the rash appears. The only medicinal treatment adopted has been ipecacuanha-wine with acetate of ammonia, with a boric-acid wash for the eyes in those cases which were complicated by catarrhal inflammation of the lids. Stomatitis occurred in about one-half of the cases and invariably yielded to the application of a saturated solution of chlorate of potash. A. Dunley Owen (Lancet, June 20, '97).

If ichthyol salve can be applied in measles from the very first, it aborts the infection. If the eruption is already apparent, with hyperthermia and bronchitis, the temperature returns to normal after one or two rubbings, and the patches grow pale and disappear. In four or five days the cure is complete, when a warm bath is given to remove the traces of the salve. The salve is rubbed in all over the body, morning and night: 7 ½ drachms of ichthyol to 3 ounces of lard. A. Strizovere (Jour. Amer. Med. Assoc., Apr. 30, '98).

The hard metallic cough is one of the most troublesome symptoms of the disease. Very little relief, however, can be afforded by treatment before the fever begins to subside. It cannot be loosened by the administration of nauseating expectorants. They tend to render the child more irritable and to increase the anorexia and have but slight effect on the cough. Small doses of opium aid in allaying the cough, and are quite permissible. Brown mixture in the form of tablet triturates is as effective as any treatment and is easy of administration.

Cool water and ice-pellets give some relief in the cough of measles. A mixture of bromides, chloral, and deodorized tincture of opium in a syrupy vehicle gives good results. Tyler (Amer. Jour. of Obstet., Aug., '88).

Though hyperpyrexia is uncommon in measles, the fever sometimes requires attention. The effect of the fever upon the patient is a better guide for treatment than is the thermometer. If the child becomes restless or delirious, small doses of phenacetin are admissible. Only enough should be given to reduce the temperature moderately and to allay restlessness. Cold sponging is the best treatment for high temperature and is far preferable to the administration of large doses of antipyretics.

Use of cold baths in ataxo-adynamic forms of measles followed by marvelous results. Juhel-Renoy and Duponchel (La Tribune Méd., May 15, '90).

Case of measles, rapidly assuming the malignant form, apparently cured by cold baths, but improvement did not appear until after the fourth bath. As a consequence of the cold baths, the suppressed function of the kidneys was resumed. Dieulafoy (La Méd. Mod., June 26, '90).

Thirty-six cases of measles in children successfully treated in the following manner: The entire body of the child was immersed in cold water, rubbed with a moist sponge, and the trunk covered with a cloth wrung dry out of cold water. The ablutions should be made every hour if the temperature rises above 102.2° F., but only once at night. Even after disappearance of the fever cold or

warm baths should be given. J. Fodor (Blätter f. klin. Hydrotherapie, etc., July, '91).

In the eruptive fevers hydrotherapy affords better means of controlling the pyrexia and the accompanying nervous phenomena than treatment by antipyretic remedies. Pulmonary congestion and broncho-pneumonia are also favorably influenced by baths, the water being gradually cooled, while cold water is poured on the head. Guinon (Blätter f. klin. Hydrotherapie, etc., July, '91).

Life was prolonged in two or three cases of measles by means of gavage, or forced feeding. In cases with cyanosis, high temperature, and great dyspnœa, hot mustard baths, and mustard to the entire body seemed to be more serviceable than any other means used. L. Emmett Holt (Brit. Med. Jour., Mar. 18, '93).

Literature of '96-'97-'98.

Antipyrine valuable as an antithermic in measles. This drug is given to patients when their temperature reaches or exceeds 103°, the following formula being employed:—

℞ Syrup, 3.8 ounces.
Antipyrine, 75 grains.

Editorial (N. Y. Med. Jour., Feb. 8, '96).

As a rule, hydrotherapy is unnecessary in measles, but should the following conditions arise it is useful: Should the patient be stuporous, or if there be marked delirium and convulsions, cold affusions at 60° to 70°, lasting for two minutes, may be applied to the head and neck. If this is insufficient to reduce the temperature, then a bath of 70° to 80°, lasting for five minutes, with colder affusions to the head, may be used. Should there be signs of laryngeal stenosis, it may be well to place the child in a hot bath or in a hot pack for from fifteen to twenty minutes. Should the face become very much congested, cold affusions may be applied to the head or an ice-bag may be used. Should the temperature become subnormal, a hot bath may be given accompanied by energetic rubbing. Where there are evidences of catarrhal bronchitis it may be well to apply sudden cold affusions to the chest and to follow these immediately afterward by the administration of an emetic. Jurgensen (Blätter f. klin. Hydrotherapie; Therap. Gaz., July 15, '98).

Uncomplicated cases do not require stimulants. Broncho-pneumonia requires the same treatment that it would receive under other conditions. Other complications must be treated as they arise.

Medicinal treatment not considered necessary in cases which run the regular course. Alimentation is the treatment for high temperature. Suggestion of Semmola and Dujardin-Beaumetz to substitute glycerin for alcohol is a very good one. An ounce of glycerin may be given daily, combined with about 8 ounces of water and ½ drachm of citric or tartaric acid.

Treat broncho-pulmonary complications with a combination of infusion of ipecacuanha, tincture of aconite, and syrup. When the cough is particularly rebellious, good results are obtained by giving iodide in combination with bromide of sodium. Montefusco (Revue Mens. des Mal. de l'Enfance, Aug., '88).

Use of potassium iodide in daily amounts of 3 to 12 grains advised, in the broncho-pneumonia of measles. Bicente (N. Y. Med. Jour., Apr. 21, '94).

Epidemic of measles in a young girls' seminary, with 16 per cent. of acute lobar pneumonia. Digitalis in large doses. No depressing effect upon the heart. Lomikovsky (La Méd. Mod., Feb. 27, '95).

Successful stamping out of broncho-pneumonia, occurring as a complication in a hospital. Child given sublimate baths; every sore, abscess, or crust of impetigo carefully dressed; nose and fauces irrigated several times daily with boric solution or boiled water; every child affected with broncho-pneumonia promptly isolated. Hutinel (La Méd. Mod., Jan. 26, '95).

Following treatment employed in the paralysis following measles: Should paralysis depend upon simple congestion of the marrow it is to be treated with ergot, strychnia, and the galvanic cur-

rent to the spine, followed by a cold douche, the faradic current being employed at the same time. This should be followed by dry friction, sulphur- and sea- baths. If the symptoms do not subside, iodide of potassium should be given in small doses. Heat may be applied to the spine or an eschar made with the thermocautery. Calomel in small doses is of service. Should respiration become difficult or the heart fail, artificial respiration and injections of ether must be used. If congestion is evident, a wet cup should be applied to the nape of the neck. In case of retention of urine a catheter must be passed two or three times a day. Bayle (Revue de Thér. Medico-Chir., Mar. 1, '88).

Literature of '96-'97-'98.

The treatment of measles should be directed to the prompt development of the eruption. For this purpose the iodides with diaphoretics are valuable. In cases of retarded eruption, the sheet pack wrung out of hot water in which a tablespoonful of mustard-flour has been steeped has proved effectual. The bowels, if constipated, should be relieved by enemata. The apartment in which the patient remains should be airy and well ventilated, without draughts, and with facilities for maintaining a moderate amount of darkness, and an equable temperature, night and day, of 70° F.

To develop the eruption and allay incessant laryngeal cough the following may be given:—

℞ Syrup of hydriodic acid.
Syrup of Dover.
Syrup of Tolu, of each, 1 ounce.

The Dover syrup to be lessened for infants.

During the eruptive stage and throughout a broncho-pneumonia give:—

℞ Potassium acetate, 2 drachms.
Solution of ammonium acetate,
Camphor-water, of each, 3 ounces.

A teaspoonful to be given every hour to a child, and a tablespoonful every hour to an adult. This treatment should be accompanied by the use of copious draughts of water. J. A. Larrabee (Pediatrics, Oct. 1, '97).

Cocaine has proved a sovereign remedy in bringing out the eruption in a few hours in three cases of abnormal measles. Generally it was administered in a daily amount of 0.3 grain to children five years old. M. Poulet (N. Y. Med. Jour., June 5, '97).

Phlyctenular conjunctivitis with its array of dangerous complications, including ulceration of the cornea, is often witnessed in dispensaries as a sequel of measles. This is mainly due to the fact that text-books on diseases of children do not lay sufficient stress upon the importance of keeping the lids aseptic by careful cleansing, and not using the eyes for reading, writing, etc., until the system has completely recovered from the debilitating influence of the disease, in which the ocular muscles take an active part.

During convalescence, unusual care should be exercised in avoiding unnecessary exposure. Tonics should be given freely. The various sequelæ should receive proper attention, and the particular susceptibility to tuberculosis should not be forgotten.

Floyd M. Crandall,
New York.

MEDIASTINUM, DISORDERS OF THE.

Mediastinal Abscess.

Symptoms.—In an analysis of over one hundred cases Hare found that the most constant and severe symptom of mediastinal abscess was pain, unless the formation was cold abscess, when the pain was a very unimportant factor. In both the acute and chronic form flashes of heat and rigors may occur, particularly the latter in the acute forms.

Pulsation may be perceptible by palpation and by the sensation of the patient from the pressure on large blood-vessels, and the sense of pulsation is intensified

by the outside pressure upon the accumulation. Abscess of the posterior spaces may, by its pressure on the nerves as they leave the cord, produce violent pain in the anterior wall of the chest. Dysphagia is not so marked as in other growths of the chest. There is a sensation of weight under the sternum, the tissues overlying the latter being frequently œdematous. Dyspnœa is occasionally complained of. General symptoms—fever, anorexia, etc.—are usually present, and become quite marked when the accumulation of pus is marked.

Case of abscess of posterior mediastinum, with cyanosis and subcutaneous emphysema; venesection; recovery by discharge through the lung.

A remarkable feature was a high degree of subcutaneous emphysema, which extended over the neck and the upper part of the chest. William Pepper (Inter. Med. Mag., Feb., '92).

Case of mediastinal abscess in a soldier upon whom a heavily-laden sack had fallen while he was lying down. Some days afterward he experienced severe pain in respiration and gradually became weak and emaciated. Some eight months later he noticed a tumor the size of a hazel-nut on the right edge of the sternum above the second rib. This grew rapidly, and in a month he could only breathe when lying down, the sense of pressure being very great. An incision over the tumor brought 12 3/4 ounces of pus from above the sternum. The size of the incision was increased. Abundant irrigation and cauterization with zinc chloride at 10 per cent. were then employed, with tampons of iodoform gauze, but no sutures. Recovery was uneventful. Hassler (La Sem. Méd., Oct. 10, '94).

Diagnosis.—The pressure on the important nerves involved the pneumogastric, the recurrent laryngeal, etc., and the vascular trunks sometimes markedly simulate aneurism. The difficulty in breathing and the brassy sound of voice recall the symptoms of thoracic aneurisms. But the violent pain at times experienced by aneurisms is usually absent, though there may be marked discomfort.

An exact diagnosis in suppuration of the mediastinum is important, owing to the probability of rupture of an abscess into the serous cavities, terminating in pleuritis, peritonitis, pericarditis, or later septicæmia.

Case of abscess of the mediastinum, consecutive to tracheotomy, with sudden death. The patient was a child with croup. A sac of pus enveloped the pneumogastric nerve. Fromaget (Jour. de Méd. de Bordeaux, Feb. 15, '91).

Etiology.—Mediastinal abscesses may be idiopathic, secondary, or traumatic. The idiopathic form is quite rare; the secondary form may result from lesions in neighboring parts, — the neck or thorax, — while the traumatic follows blows, contusions, penetrating wounds, and fracture of the overlying bones. Abscess of the mediastinum affects males more frequently than females. In Hare's cases the proportion was as 58 is to 10. The anterior mediastinum is the most common seat for its development (in the proportion of 48 to 19 instances of the disease in all the other spaces). The proportion of acute to cold abscess was also noted by Hare to be as 40 is to 31 in 111 cases examined. Mediastinal abscess is nearly as frequent as cancer: it occurred in 136 cases of the 520 growths collected. Abscess is more frequent than sarcoma, of which only 90 occurred, of the last number mentioned.

Mediastinal abscess is occasionally a symptom of Pott's disease, especially if the two lower cervical vertebræ are involved. It also occurs as a complication after tracheotomy or œsophagotomy. The most frequent cause, however, seems to be pericarditis.

Pathology.—Mediastinal abscesses are attended usually with obstruction, to a

greater or less extent, of air- and blood-channels from the pressure upon them, and are recognized by dullness on percussion over the region involved. An opening may exist, or bulging of the ribs with pulsation may occur, but such an accumulation in the mediastinal spaces may not reach the exterior surface, owing to the sternum in front and the spinal column with the heavy muscles behind, while abscess of the middle mediastinum must involve the lungs or the lateral spaces before coming into notice.

Treatment.—The only safe course in such cases is to trephine the sternum and to carefully explore the mediastinum, ascertaining with an exploratory needle whether pus is present. This is usually ascertained without trouble. The cavity should then be opened, gently washed out, and drained.

The advantage accruing from drainage in other parts is greater in mediastinal abscesses, and early incision, or resection of a rib or portion of the sternum, is not only indicated, but demanded. The urgent symptoms calling for this course may be mentioned:—

1. Dysphagia, or pressure upon the œsophagus.

2. Enlargement to the left of the sternum, and at times to the right.

3. Displacement of important organs, such as the heart or lungs.

4. Dullness and flatness of the region of the lungs.

5. Thorough drainage may be made also when the cause of trouble is a cyst or a serous collection; so that no special difference need be made.

> Case of dermoid cyst of the anterior mediastinum in a soldier 22 years of age. The whole right chest was enlarged. After three weeks of expectant treatment 25 ounces of yellowish liquid were withdrawn by aspiration. The fluid was not purulent. Improvement followed at once. A. Dardignac (Revue de Chir., Sept., '94).

6. Chills or hectic indicate pyæmia, and call for systemic as well as local treatment.

Mediastino-Cardiac Disorders and Injuries.

The heart is intimately associated with almost all of the contents of the whole mediastinum, but especially the large veins and arteries, which commence or terminate, as the case may be, within the pericardium.

Mediastino-pericarditis is a frequent complication of mediastinal inflammation and usually terminates in serous effusion before it is fully recognized. At times the serous effusion is absorbed, as is the case in pleural effusions of a serous nature. The afebrile type of pericarditis may be fatal, however, and no effusion exist. The most serious result is suppurative pericarditis.

Treatment.—Aspiration and drainage are indicated in serous pericardial effusions. Incision and drainage should be performed for the relief of suppurative pericarditis. The site for either of these operations is that between the fourth and fifth ribs,—about one inch to the right or left of the sternum.

Literature of '96-'97-'98.

> Operation is indicated in all cases of purulent pericarditis. The operator should avoid opening the pleural cavity, open the pericardium opposite the point where drainage would remain good after contraction of the sac, and secure permanent free drainage. C. B. Porter (Med. News, May 8, '97).

> Pericardial effusions should be treated in the same manner as pleural effusions, paracentesis being insufficient to cure suppurative pericarditis. Incision and drainage are essential, and should be executed as soon as the diagnosis of pus in the pericardium is made. The diagno-

sis of the purulent character of the effusion is determinable only by exploratory puncture. This should be done at the upper part of the left xiphoid fossa, close to the top of the angle between the seventh cartilage and the xiphoid cartilage. Pericardiotomy should then be done after resection of the fourth and fifth costal cartilages, raising a trap-door of these cartilages and using the tissues of the third interspace as a hinge. The mammary vessels and pleura are thus exposed and pushed to the left. The prognosis is good after pericardiotomy for pyopericardium. Of 26 collected cases there were 10 recoveries and 16 deaths. Of the fatal cases, 9 were septic, and all the others which died had complicating lesions,—pulmonary, cardiac, or renal. J. B. Roberts (Med. News, May 8, '97).

Injuries.—Wounds of the heart and pericardium may now be classed as other injuries of a similar kind, since Rehn has successfully sutured penetrating wounds of the heart with catgut. Rehn recommends free opening in cases of hæmothorax, and in hæmopericardium this is necessary to prevent the formation of bloody froth. (James P. Warbanes, Annals of Surgery, Nov., '98).

Among the rarer injuries to the contents of the mediastinum that may be mentioned is rupture of the heart, which has been demonstrated post-mortem. It may be diagnosticated by the peculiar pallor, the sudden cessation of the rhythm and beat of the heart, together with the total irresponsive condition of the circulation to all stimulants.

Mediastinal Vascular Disorders and Injuries.

Diseases.—The diseases of the blood-vessels of the mediastinum are those found in the vascular supply of other parts, viz.: aneurism, phlebitis, arteritis, etc. (See Aneurism and Vascular System.)

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Case of aneurism of the transverse arch of the aorta that ruptured into the mediastinum and dissected along the muscles and about the pharynx and larynx, causing death. There was marked lividity and swelling of the face and neck and some dyspnœa. J. O. Affleck (Edinburgh Med. Jour., June, '98).

Treatment.—Inunctions of mercurial ointment, iodine, belladonna, and camphor ointments may be made externally, so as to combat inflammation. Depletion by calomel and soda, or by venesection, has given marked relief.

Wounds.—The vascular trunks passing through the mediastinum are so disposed that a missile which penetrates the cavity may traverse it without wounding any important vein or artery. The aorta and vena cava, when wounded, obviously do not admit of time for any arrest of the hæmorrhage. The most prudent course to pursue in all penetrating wounds is to hermetically seal the outer wound, after turning the patient upon the side affected, so that all blood may be allowed to escape. This course has recently stood the test of experience in military surgery, and Senn counsels it, in preference to opening the wound and ligating any bleeding vessels. In case a great amount of blood should collect in the mediastinum, it may be evacuated posteriorly by resection of a portion of the rib near the point of the greatest collection. The rise of temperature noticed after wounds of this character betokens more the absorption of fibrin than actual hæmorrhage.

[In the senior editor's experience a case occurred in which a pistol-shot traversed the mediastinum, the ball entering immediately over the heart and lodging upon the sixth rib of the right side behind the axillary line. The external wound was occluded, and the ball

was not removed until after the general shock and slight inflammatory reaction had passed off. The patient made a good recovery by the strict observance of masterly inactivity.

This case — compared to another in which the external wound was left open, terminating fatally — emphasizes the caution against cutting down and extracting a ball under such circumstances at the outset. The practice of removing balls lodged between the ribs is more honored in the breach than in the observance. When an opening already has been made by the entrance of a ball, it is not good surgery to make another for the extraction, until the wall behind has become solidified. J. McFadden Gaston, Sr.]

Thoracic Duct. — This may be the seat of disease through the extension of inflammation in the various forms of mediastinitis; or it may be itself in a normal condition and be the recipient of direct or indirect pressure sufficient to rupture its walls with extravasation of contents. Again, it is often the only part involved in a stab-wound of the mediastinum. The chyle cannot be lost to the system without serious results, and most wounds of the thoracic duct are fatal. At times, however, spontaneous closure of the wound occurs, when the incision is a longitudinal one.

[A recent case of recovery reported by H. W. Lyne, of Richmond, Va. (Virginia Med. Semimonthly, Aug. 26, '97) demonstrates the possibility of so desirable an ending.

The thoracic duct was ruptured, and closed spontaneously in the case of a child reported by Kirchner (Arch. f. klin. Chir., '85, p. 156). The displacements of heart, liver, and other organs was very marked.

The treatment in this case consisted in a puncture and evacuation of a portion of the fluid, followed by active purgation. The child had been violently thrown against a window-sill, so that she was injured about the level of the third rib. The puncture revealed the fluid extravasated to be chyle. Six months after the accident, the girl is described as being in better health than before it.

The wounds of all kinds have been few if they have been recorded. W. W. Keen, of Philadelphia, has had one case of operation-wound of the thoracic duct. The wound was sutured very carefully with the finest semicircular Hagedorn needle and fine silk, and no untoward result occurred. The weight of the patient was carefully taken for some days after the operation and no great decrease was noticed. Keen records three other cases of wounds in the cervical portion of the thoracic duct.

These cases were also operation-wounds. One, that of Cheever (Boston Med. and Surg. Jour., '75, p. 422), died from exhaustion. Another case was Boegehold's (Arch. f. klin. Chir., '93, vol. xxix, p. 443). Wilms was the operator, and the patient recovered. The third case was in an operation of A. M. Phelps, of New York, who communicated the facts to Keen personally. The operation occurred June 4, and on June 11th the wound was closed by hæmostatic forceps, and the patient recovered, beginning to gain in weight after the closure.

Twenty cases of wounds of all kinds are mentioned, and many observations made during the treatment of them, leading to the inference that the duct was closed spontaneously in some of these cases and a collateral anastomosis was established; but the continual escape of chyle may cause death by the pressure of the extravasated fluid, resulting in pleuritis, or that death may be attributed to the immediate exhaustion, as in Cheever's case.

The usual size of the thoracic duct is that of a goose-quill, and the jet of chyle will be of low pressure and about the diameter of a straw. The junction of the left subclavian vein with the jugular vein is the site for the mouth of the duct to be found, but anatomists call attention to the somewhat frequent change in the location, due to the fact that the duct may empty its contents into the left subclavian vein by several mouths, comparable to the delta of a river (Med. and Surg. Reporter, May 12,

'94). J. McFadden Gaston, Sr. and Jr.]

Lymphatic Glands.—The lymphatic glands of the mediastinum are divided by Baréty into three sets: (1) the right and left peribronchial; (2) the right and left subbronchial; and (3) interbronchial. All these are particularly liable to inflammatory process.

Three cases in which mediastinal glands invaded the lungs, all in children under two years of age. Caseous glands in children found present in 110 cases out of the last 300 necropsies made at the Children's Hospital. Their occurrence apart from some tuberculous affection doubtful. Voelcker (Brit. Med. Jour., May 9, '91).

Inflammation of the cellular tissue may be acute or chronic, primary or secondary. Inflammatory changes may be circumscribed or diffused. The condition of the tissues in the neighborhood is to be taken into account in determining the inflammation. (See Adenitis.)

Tumors of the Mediastinum.

Symptoms.—The attachments of the tumor and the encroachment of the rapid growth necessarily have important bearings upon the symptoms manifested. For instance, in multiple sarcomata of the heart the heart-beat is rapid and irregular, but there may be no murmurs unless the valves are encroached upon. At times, instant death is caused by the pressure of the tumor upon the spinal cord—exposed by the erosions of vertebræ.

The adjacent organs, as well as the connective tissue forming the immediate seat of the tumor, being hyperæmic, the blood is unaërated if great pressure occurs, and cyanosis of the face, with varicosity of the veins of the chest and neck, occurs. The lymphatic glands of the neck are enlarged, especially the subclavicular.

Pressure upon the œsophagus causes dysphagia, and at times ulceration into the œsophagus. The ulceration may occur between the tumor and the trachea or thoracic duct.

The pulse is unequal; there is dullness of a fixed area near the sternum or clavicle, and often a distinct œdematous condition of the arms, neck, and chest; so that the arms may measure more in the circumference than the legs. Displacement of the heart- or lung- tissue occurs. Dyspnœa soon shows itself, but not to the extent that it does in pleurisy or empyema. Pain from motion, if adhesions are interfered with, may occur in some cases; but ordinarily very little pain is present. Exophthalmos is a frequent symptom, when the thyroid is involved in the tumor. Nervousness: the patient will often be unable to locate the seat of inconvenience.

Literature of '96-'97-'98.

The special features of mediastinal tumors may be illustrated by the following cases:—

Case I.—The tumor gradually encroached upon the heart so as to displace it one inch and a half to the left of its usual site. Temperature varied between 99°, 100°, and 102°. The pulse was 76. The left lung was collapsed and the sciagraph showed a shadow from the second rib to the diaphragm and from two inches to the left of the sternum to the left border of the chest. Aphonia supervened and the lungs were more and more collapsed. The left bronchial tube was occluded. The patient was improved, but not cured, by the use of chloride of calcium combined with iodide of potassium. A dosage ranging from 10, 15, to 20 grains of the former was added to 3 grains of iodide of potassium. The latter drug could not be tolerated in doses of 7 ½ grains. E. Fletcher Ingals ("International Clinics," '97).

Case of hæmorrhagic adenochondrosarcoma of the anterior mediastinum arising

from the thymus gland, in a man of 20 years. He had shown swelling of face, neck, and left arm; dullness between the sternum and in the left infraclavicular fossa, near the sternum as far down as the third costal cartilage. There was bronchial breathing near the root of the left lung and enlarged veins over the front of the sternum. The apex-beat was felt on admission, but soon ceased to be palpable, and the heart-sounds became extremely distant. Later there was dullness and loss of breath-sounds over the left lung, but, as effusion was suspected, paracentesis was performed in the left midaxillary line, and 40 ounces of blood-stained fluid withdrawn from a distended pericardium. This gave relief, but the patient became more dyspnœic and delirious, and eventually died two months after admission. At the autopsy a growth was found occupying the superior and anterior mediastinum and covering over half of the pericardium, to which it was adherent. H. D. Rolleston (Jour. of Path. and Bact., Jan., '97).

Diagnosis. — The symptoms which have been mentioned may serve the purpose of differentiating tumors of the mediastinum from abscesses if there is not present pain, chills and fever, elevated temperature, or very marked emaciation or apparent ill health. The age is also a means of determining upon a correct diagnosis. Benign or malignant tumors of the mediastinum may occur at any age, but aneurismal tumors usually occur after the age of forty-five.

The male and female suffer equally, though our own cases have been female.

Record of 134 cases of mediastinal cancer, 98 cases of sarcoma, 115 cases of abscess, 16 cases of non-suppurative inflammation, 21 cases of lymphoma, 7 cases of fibroma, 6 cases of hæmatoma, 11 dermoid cysts, 8 hydatid cysts, and 104 cases of various mediastinal diseases. Conclusions: 1. Cancer is more frequently found in the mediastinal spaces than any other morbid process. 2. Abscess is the morbid process next in frequency of occurrence. 3. Sarcoma occupies the third position as to frequency of occurrence. 4. Lymphomata and lymphadenomata occupy a fourth place, but are much more rare than the others mentioned. 5. The anterior mediastinum is affected far more frequently than the other two spaces. 6. Most mediastinal growths occur in adults. 7. More males are affected by forms of mediastinal disease than females. 8. Cancer and sarcoma of this space are necessarily fatal. 9. About 40 per cent. of the cases of abscess recover. Hare ("Fothergillian Essay," '89).

Cancer of the mediastinum, despite the statistics of Hare, are nothing like as frequent as sarcoma of that region, or especially lymphosarcoma. Steven (Glasgow Med. Jour., June, Aug., '91).

Review of 67 cases of carcinoma of the mediastinum in children found in literature. As compared to adults, sarcoma is the most frequent morbid process, carcinoma next, and abscess third in order. Edwards (Archives of Ped., July, '89).

Eight cases of primary malignant growth of the anterior mediastinum. The patients were all over 40, with the single exception of a woman aged 23, a very acute case of carcinoma. Two were over 60. The history of illness dated from not more than six months. The disease was accompanied by pleural effusion in 4 cases, purulent in 1, and chylous in another. Letulle (Archives Gén. de Méd., Dec., '90).

Case of carcinoma of the mediastinum in a young woman 27 years of age. The patient died of cyanosis, the diagnosis of tuberculosis having been made. The autopsy showed the mistake; also a neoplasm, which occupied the anterior and superior part of the mediastinum. Histological examination revealed carcinoma of fibrous stroma, well developed, presenting nothing special. Tissier (Bull. de la Soc. Anat., Dec. 20, '89).

Case diagnosed as aneurism of the aorta with paralysis of the recurrent, but which at the post-mortem examination proved to be a mediastinal carcinoma. In making a differential diagnosis between the two affections, it must be noted that paralysis of the recurrent, due to a mediastinal tumor, develops gradually. Hoarseness sets in, but again passes off,

and a paresis can be demonstrated only after a considerable time. In aneurism the paralysis of the vocal cord is often the first symptom. Hæmorrhages are always an indication of the approaching end in aneurism, while in tumors there is not infrequently hæmoptysis at an earlier date. Schadewaldt (Laryn. Soc. of Berlin, '95).

Literature of '96-'97-'98.

Case of steel-dust deposit in the mediastinum. The steel was inhaled during work in a factory and caused considerable inflammation within the chest; gradually discharged from a sinus in the jugular fossa. Sciagraph showing opaque areas in the mediastinal space. M. W. Bacon (Phila. Med. Jour., Feb. 19, '98).

Prognosis. — Early treatment may cause a subsidence, if not a disappearance, of the disease.

Demantké has put on record a case of tumor of the mediastinum of very short duration. It occurred in a man aged 26. He died of suffocation, and the autopsy showed the tumor to have rested on the pericardium below, and to have extended up into the neck about the level of the clavicle.

Treatment.—Tumors of the mediastinum call for treatment according to the etiology of the disease present.

Syphilitic tumors require antisyphilitic medication. The most serious obstacles to operative intervention are encountered, but when a trap-door allows free access to the mediastinum, and the X-ray serves to diagnosticate bullets and tumors, great advance has been made toward the exploration of the important portion of the body, and we may hope for the removal of tumors.

Treatment of Mediastinal Disorders.

Surgical.—Operative procedures may be carried into the various portions of this division of the thorax with a fair prospect of affording relief to some pathological conditions heretofore regarded beyond the reach of surgery. Experimentation on animals, though not a sufficient test, has still demonstrated the feasibility of surgical interference in this comparatively-unexplored region. If animals can survive the traumatism of entering the mediastinum from the front and rear of the thorax, as has been verified by experiments of Le Moyne Wills, De Forest Willard; Levy, of Berlin; and Zakharevitch, of Russia; it is evident that operations may be undertaken for the relief of mediastinal tumors, hydatids, and other morbid growths of this space.

Clinical observation upon the human subject has shown that diseased structures of the chest, as in other parts of the physical organism, are more tolerant of surgical interference than in traumatism of the contents of the thorax in their normal condition. It is therefore inferred that the operations upon the thoracic walls, and upon the tissues of the lung under abnormal conditions which are indicated, will be warranted in all such cases as have proved safe in the experiments upon dogs and rabbits. On the other hand, it is not a necessary consequence that operations upon the diseased structures of the chest in the human subject shall prove hazardous, because experiments on inferior animals in a healthy state have been unsatisfactory or have turned out unfavorably.

[The senior editor has proposed an improved method for exploring the thoracic cavity. R. F. Weir and J. D. Bryant have proposed openings into the mediastinum from the rear, while the operations of Jennings, Lowson, and Delorme contemplate the exposure of the contents from the front, but by the section of ribs at both sternal and lateral extremities, according to the incisions in the skin-flap. The improvement that is expected to be accomplished is in only one section

of the bones, using the cartilages of the ribs for hinges.

The arm upon the side to be examined should be raised above the head. An incision is made in the midaxillary line, directly downward, from the third to the eighth rib, inclusive or exclusive, as the case may warrant, with the division of the ribs either with the saw or bone-cutter, extending to the pleural lining without dividing it. Temporary means of arresting hæmorrhage should be employed, and afterward there should be a transverse incision carried forward from the upper extremity of the perpendicular along the upper border of the third or fourth rib, and another from the lower extremity along the upper border of the seventh or eighth rib, as may be requisite, extending in front to the costal cartilage. Any bleeding should be controlled before dividing the parietal pleura, in making either of these incisions. Scissors which have a blunt point on the internal blade may be used for dividing the pleura on each line, and, if the lungs have not collapsed previously, this will occur upon the entrance of the air into the chest. J. McFadden Gaston, Sr. and Jr.]

Literature of '96-'97-'98.

Considerable areas of the sternum can be resected with impunity. Seventeen cases collected in which masses of the sternum were removed for various diseases. Personal cases: One of resection of the manubrium, inner third of the left clavicle, and lower third of the left sterno-cleido-mastoid for sarcoma. The second case was one of carcinoma of the breast with secondary carcinoma of the sternum at the junction of the manubrium and gladiolus. Both breasts were successfully removed, and resection of parts of the manubrium and gladiolus was followed by recovery from the operation; but death from recurrence of the trouble occurred subsequently. W. W. Keen (Med. and Surg. Rep., Mar., '97).

Medical Treatment. — The use of chloride of calcium in glandular enlargements of the neck has been recommended by Thomas J. Mays, and is a corroboration of the confident use of it in cases of mediastinal tumors.

Arsenic is also useful. It may be combined with mercurials, iodides, such as in the preparation known as Donovan's solution.

> Medical treatment may lead to retrogression or, at least, the arrest of such growths when benign. Arsenic must be given the first rank, and iodide of potassium in increasing doses and for a long enough time to judge of its effects in doubtful cases, as syphilis is always to be thought of. Millot Carpentier (Revue Inter. de Méd. et de Chir., Feb. 10, '95).

Inoperable mediastinal tumors may be successfully treated by means of electrolysis and cataphoresis, using the negative pole when and where dissolution is needed and the positive with Donovan's solution where the cataphoric action of the drug is expected.

The exact diagnosis may not always be made, but the case may be treated in this way when the typical symptoms give presumptive evidence of sarcoma of the mediastinum. Less encouragement is promised for carcinoma.

J. McFadden Gaston,
J. McFadden Gaston, Jr.,
Atlanta.

MEDITERRANEAN FEVER. See Malarial Fevers.

MELANCHOLIA. See Insanity.

MÉNIÈRE'S DISEASE. See Internal Ear.

MENINGITIS.—Gr. μηνιγξ, membrane; ιτις.

Meningitis (Cerebral).

Varieties.—Cerebral meningitis means inflammation of the meninges of the brain.

Pachymeningitis means inflammation

of the dura mater. Pachymeningitis is external or internal, and acute or chronic in its duration.

Leptomeningitis means inflammation of the soft membranes, the *arachnopia*. The term "arachnopia" is here used to denote the pia mater and the so-called arachnoid membrane, which are always involved together in leptomeningitis. Leptomeningitis occurs as an acute or chronic disease, and when acute includes many etiological varieties, while the causes producing chronic leptomeningitis are much more obscure.

It will be convenient to consider the subject of meningitis in the order indicated above, all the etiological varieties of acute leptomeningitis being included in the description of that disease. Inflammation of either membrane may spread to, and include the others; or the brain-substance itself, constituting a meningo-encephalitis.

External Pachymeningitis (Cerebral).

Definition.—External pachymeningitis means inflammation of the external layer of the dura mater. It is almost always secondary, and almost never a primary affection.

Symptoms.—The symptoms of external pachymeningitis are usually of very indefinite character, and vary according to the position, extent, and grade of the dural inflammation. When it follows traumatism there may be intense headache, nausea, vomiting, delirium changing into coma, local or general spasms, and, finally, unless relief is afforded, the collection of pus may cause more decided signs of septic infection and increased intracranial tension. In all cases the condition of the ears should receive the most careful scrutiny, since many of the cases are associated with suppurative aural disease. As the symptoms in themselves are by no means conclusive in their character, or in the mode of their development, a very careful study should be made of all the possible causes whenever this condition is suspected to exist.

Literature of '96-'97-'98.

Case of wound of the eyeball which became septic and after enucleation death ensued from meningitis ten days after the operation. Bacteriological examination of the purulent exudation demonstrated the presence of the diplococcus pneumoniæ. Lapersonne (L'Echo Méd. du Nord, May 9, '97).

Six thousand five hundred and eighty eyes excised at Moorfields Hospital, among which eight fatal cases have occurred. From report of five of these cases with autopsies and microscopical examinations, the following conclusions are reached:—

1. Meningitis may be present for a certain time without there being sufficient symptoms to enable one to diagnosticate the disease.

2. Meningitis has been known to follow other operations besides the excision of suppurating eyes, and cases are also recorded in which the excision of an eye which was not suppurating has been followed by death from meningitis.

3. The changes seen in many cases indicate that the disease is of older standing than the symptoms would appear to indicate.

4. Infection may occur at any time from an eye which is suppurating, and the longer the pus is shut up in the eye the greater is the risk and the greater will be the absorption of products of suppuration.

5. There are two ways in which meningitis may arise: (*a*) by direct extension along the optic nerve and structures passing through the sphenoidal fissure; (*b*) by infective material's being carried along the vessels.

6. The sooner the pus is got rid of the better; and, if it is thought not desirable to excise the eye, it should be at once opened, the contents completely removed, the sclerotic thoroughly scrubbed out, and both it and the surrounding parts rendered aseptic.

7. As the products of putrefaction may have soaked into the sclerotic and infected the surrounding parts, it is far better to remove it; good drainage is then insured, and every piece of useless and suppurating tissue is removed. C. D. Marshall (Royal London Ophthal. Hosp. Rep., vol. xiv, p, 305, '97).

A senile form of external pachymeningitis, running a more or less chronic course, is observed among chronic alcoholic subjects and those who have previously had syphilis or certain infectious diseases, such as erysipelas of the head. The symptoms present in such cases are those of senility with headache, usually vertical in position.

Literature of '96-'97-'98.

Case of meningitis due to streptococci and secondary to facial erysipelas. Fluid removed by lumbar puncture twenty-four hours before death gave pure culture of streptococci. Examination of the blood was negative. Jemma (Gaz. degli Osped. e delle Clin., No. 66, '96).

Diagnosis.—The diagnosis of external pachymeningitis can only be made by a careful study of the antecedent or associated conditions to which the affection is commonly secondary. The symptoms which may be present in these cases are simply those of cerebral irritation, and, in some cases, of cerebral compression, to which are added the general signs of the existence of a septic condition in the cases in which pus is formed. In cases running a more or less acute course the diagnosis will be made by a careful study of the history of the illness and of the associated conditions found upon examination of the patient. The history should especially refer to any traumatism or syphilitic infection. In the chronic senile cases the diagnosis must be largely inferential, when persistent dull headache is associated with mental deterioration and a history of alcoholism or syphilis.

Etiology. — External pachymeningitis is commonly associated with traumatism, sun-stroke, caries of the flat bones of the cranium, purulent aural disease, syphilis, erysipelas, and probably certain other acute infections. Traumatism and caries of the cranial bones are the chief etiological factors producing inflammation of the external layer of the dura mater.

Pathology.—Post-mortem examination in these cases reveals very often great thickening of the bones, especially of the inner table of the skull, and a collection of pus between the bone and the dura mater. In the syphilitic cases this thickening of the bone is often very marked. Osler refers to a case at the Montreal General Hospital in which the frontal lobes were so compressed by thickened bone and purulent effusion that the anterior vertical measurement of the brain was only 2.5 centimetres, while the similar posterior measurement was 8 centimetres. In other cases the bone is slightly, if at all, affected, while there is considerable thickening of the dura mater, consisting of a partially-organized connective tissue, which may be softened and broken down in particles. This condition is chiefly observed in senile subjects, and is usually associated with widespread vascular degeneration. During my residence at the Morris Plains Hospital several such cases came under observation, and I have no doubt but that the post-mortem records of the hospitals for the insane will reveal this lesion as quite common among the chronic and senile insane.

Prognosis.—The prognosis is always grave, and especially so in cases affecting old subjects. When, in purulent cases due to traumatism, the collection of pus is evacuated and drained by the use of

the trephine, the outlook is better, and a final cure results in some cases. The syphilitic form is often remarkably improved by specific treatment.

Treatment.—The treatment of external pachymeningitis must include that of the primary condition giving rise to it. When suppuration occurs after traumatism, the trephine should be used with the hope of curing the patient, if the operation is done early and before the brain becomes affected by serious congestion or inflammation.

The cases resulting from syphilis should be treated actively with antisyphilitic remedies, and, if the general strength of the patient permit, large doses of potassium iodide should be given with the bichloride of mercury. The senile cases demand careful regulation of the digestion, the use of general tonic measures, and the relief of pain.

Internal Pachymeningitis, Cerebral (Hæmorrhagic Internal Pachymeningitis; Hæmatoma of the Dura Mater).

Definition.—Internal pachymeningitis means inflammation of the internal surface of the dura mater. It is almost always a chronic affection, and is far more common in hospitals for the insane than in general hospitals or in private practice. Osler states that during ten years he saw no case of this kind at the Montreal General Hospital, but while at the Philadelphia Hospital four cases were observed by him within a period of three months. The pathological meaning of the lesions found in this disease is still a matter of dispute, some authorities contending that they are primarily hæmorrhagic; while others believe, with Virchow, who first accurately described the condition, that they are primarily inflammatory. The weight of the evidence seems to the writer to be upon the side of the theory of their inflammatory origin, while it is to be admitted that certain cases appear to arise from hæmorrhage. The disease occurs in old age, or in those who have lived dissipated lives, and are prematurely aged in consequence.

Symptoms.—The symptoms of hæmorrhagic internal pachymeningitis will vary according to the extent of the lesion, which is usually bilateral. There may be paresis or paralysis, vertigo or apoplectic seizures, dull or sharp pains in the head, mental hebetude or stupor, inequality of the pupils, spastic paralysis of one or more limbs, and, as the case progresses, acute exacerbations of symptoms occur from time to time. Some writers mention optic neuritis, conjugate deviations of the eyeballs, and nystagmus as symptoms of this condition. All of the symptoms are very varied and irregular in development in different cases, and from this fact their true nature is only rarely suspected during life. During the intervals between the more acute seizures, which are usually apoplectic in nature, the patient may enjoy good general health, and only in the later stages of the disease present continuous symptoms. Severe epileptiform convulsions are sometimes marked features of these cases, having been observed by the writer in two cases which presented characteristic post-mortem lesions.

> In 1500 autopsies pachymeningitis interna hæmorrhagica met with in only 4 instances. In 3 of the 4 cases death resulted from prolonged convulsions, the fourth dying from an acute enteritis, with no symptomatic evidences of the pachymeningitis except restlessness and slight rigidity. In none of the 4 cases was there noted any paralysis. Northrup (Med. Record, Aug. 3, '90).

Speech is often slow, the mind fails more or less rapidly, and there may be acute maniacal attacks. According to

certain writers, hæmorrhagic internal pachymeningitis may occur as an acute disease in rachitic children, but such lesions must be extremely rare.

> Extensive internal hæmorrhagic pachymeningitis found in an anæmic and emaciated infant 23 months old. Northrup (Med. Rec., May 10, '90).

Finally cases presenting wide-spread bilateral lesions of this disease have been observed by the writer in which none of the above symptoms were noted during life.

Diagnosis.—The symptoms are so indefinite that a positive diagnosis is impossible. The majority of the cases are diagnosed on the post-mortem table. Persistent dull headache of the vertex, with mental hebetude and a history of apoplectic seizures at irregular intervals, with or without some form of spasm or paralysis, may cause us to suspect this lesion, especially when these symptoms appear toward the close of a broken-down and dissipated life.

> Case of pachymeningitis in a man, aged 25, who had suffered for two months from severe headache, and who was brought to the hospital comatose, with right hemiplegia and contracture, with increased reflexes.
>
> Death in seventy hours. Autopsy revealed new formation of membrane between dura and pia on left side in frontal region, with one remarkably-large, young blood-vessel, which had doubtless given rise to the large intermeningeal hæmorrhage, two and one-half ounces of which were found. Duponchel (Le Bull. Méd., Aug. 5, '88).

Etiology.—This disease, as has already been remarked, occurs chiefly among the insane and the subjects of other chronic nervous diseases. Usually the subjects affected are old or prematurely broken down by alcoholism, syphilis, or tuberculosis, or by prolonged dissipation of various kinds. By far the majority of cases occur in men. It is quite often found associated with general paralysis of the insane, and is more often still observed post-mortem in cases of terminal dementia in which no symptoms indicative of its presence were observed during life.

Traumatism and sun-stroke are thought by some to be causes of this affection; but from its very chronic nature, and the fact that it usually occurs in old age, exact information is very often wanting, and the connection between antecedent traumatism or sun-stroke impossible to trace. There is little doubt, however, that both of these causes may contribute some of the cases.

> Case of hæmorrhagic pachymeningitis in a man, aged 57, who was thrown from a tricycle with great force on his head and shoulders. Complete recovery. W. B. Goldsmith (Amer. Jour. Insanity, June 15, '88).

The most important causes clinically are those which predispose to early degenerative changes in the blood-vessel walls, and to a general weakened condition of the normal resistive powers of the bodily tissues. Heredity probably plays an important part in the genesis of these cases, in common with its influence in determining insanity and nervous diseases in general.

Pathology.—The macroscopical lesions observed post-mortem are thin or thick, highly-vascular, subdural membranes, usually bilateral, and limited more frequently to the parietal regions, although they may extend much beyond these limits. Within or beneath the substance of this poorly-organized membrane there may be found a large clot, but numerous fine capillary hæmorrhages are more commonly met with. In some of the cases no hæmorrhage is to be seen, and in these cases there is only the more or

less firm fibroid membrane, containing numerous blood-vessels and lying in contact with the under surface of the dura mater, over the vertex of the brain. Sometimes this membrane is divisible into several apparent layers, as of several successive accessions of growth; in other cases it is merely a very thin vascular membrane, stained brownish or reddish from more or less recent capillary effusions of blood. When large collections of blood are found, they are often encysted within layers of false membrane, and the blood is partially broken down, and pus may even be formed in some cases. The membrane which is supposed to be the initial lesion of this condition is undoubtedly of dural origin and derives its blood-vessels from the dural vessels. It should be remembered, however, that so good an authority as Bevan Lewis believes that the hæmorrhage is the primary lesion and that the membranes are formed from organization of the effused blood. The view of Virchow is, however, more generally accepted at the present time, and that is that the membrane is the product of inflammation and that the hæmorrhages found are distinctly secondary to the poorly-formed inflammatory membranous exudate. The cases which show very hard fibrous membranes without any appearance of hæmorrhage tend to support the theory of inflammation.

Literature of '96-'97-'98.

Two cases of hæmorrhagic internal pachymeningitis in children. Hæmorrhagic pachymeningitis is a lesion that should be thought of whenever convulsions and unnatural rigidity, with deepening coma, occur in a rachitic or cachectic child, under one year of age. The new membrane must be regarded as originating from the proliferation of dural endothelial cells, or, more probably, from the subendothelial connective-tissue cells. The new cellular connective tissue is exceedingly likely to be the seat of development of new blood-vessels with thin walls. Even in cases that may be supposed to have originated from hæmorrhage, an intimate connection must be recognized between the organization of the clot and the proliferation of dural connective-tissue cells. In some cases there seems to be little inclination to hæmorrhage; in others there are numerous, punctate hæmorrhages from the delicate vascular membrane. The membrane varies in thickness, in some cases being so delicate as to be readily overlooked, in others reaching two or three lines in thickness. C. A. Herter (Amer. Jour. Med. Sci., Aug., '98).

Prognosis.—The prognosis is most unfavorable. When the lesion can be suspected it is not usually amenable to any known treatment. Especially is this true after paralytic seizures occur and the general condition of the patient is broken down by disease. Death usually occurs from a general failure of the vital powers or acutely in one of the apoplectic or convulsive seizures.

Treatment.—As soon as the affection is suspected the constitution of the patient should be built up by hygiene, tonics, good food, rest, and every possible means used to increase his vitality. Afterward the iodide of potassium should be given in small doses for prolonged periods. When there is a history of syphilis, larger doses should cautiously be given, with the addition of small doses of mercury in the form most acceptable to the stomach of the patient.

Precedence given, in treatment of syphilitic meningitis, to the iodide of sodium. Nutritious feeding considered most important. When sedatives are required, paraldehyde is pre-eminently indicated. Dauchez (La France Méd., Sept. 12, '90).

The treatment of the acute apoplectic and convulsive seizures is that of any intercranial hæmorrhage. Perfect rest,

ice-bag to the head, with full doses of chloral and opium unless they are contra-indicated by other diseased conditions of the patient. Leeches are mentioned as efficacious by some writers. They may be applied to the temples or to the mastoid. The writer, however, has used blisters to the nape of the neck or over the shaved vertex, with seeming benefit in such cases. The bromides are also useful, in combination with opium and chloral, in controlling mental and motor restlessness during the convalescence from the attack.

Acute Leptomeningitis.

Definition.—Acute leptomeningitis, means inflammation of the arachnopia, the vascular and nutritive envelopes of the brain.

Varieties.—Acute inflammation of the soft membranes enveloping the brain occurs from a variety of causes, nearly all of which operate by infection of these membranes. In location and extent the inflammation may be basilar, cortical, unilateral, or general. Very many pathological and etiological varieties of meningitis are described. Pathologically acute leptomeningitis may be *suppurative* or *purulent*, *non-suppurative*, *serous*, *tubercular*, *syphilitic*, and *epidemic cerebro-spinal*. Etiologically the disease may be classified as *simple* (or *idiopathic*), *traumatic*, and *infective*. The infective group includes the great majority of the cases.

General Symptomatology.—The symptoms observed in cases of acute leptomeningitis will depend in great part upon the location and extent of the inflammation, while very often its symptoms will be combined with those of one or other of the acute general diseases to which the acute leptomeningitis is an accompaniment or sequel. Those symptoms which are quite common in all forms of acute leptomeningitis are headache, vertigo, fever, nausea, restlessness, somnolence, stupor, abnormal changes in the pulse and respiration, muscular spasms, optic neuritis, and spasms or paralysis of the ocular muscles. Almost any of these symptoms may be either very marked features of any given cases, or very slight, or even entirely absent. Perhaps the most constant symptoms are pain in the head, mental changes during the initial stage, fever (although afebrile cases are reported); muscular twitchings, or spastic condition of the muscles, especially those of the neck and spine; and general convulsions.

Pain in the head is a very frequent symptom, but if the disease occurs during the progress of some grave general disease it may not be complained of. Irritability, restlessness, and delirium in cases ushered in by high fever are exceedingly common, and coma very often rapidly supervenes in such cases, accompanied by more or less muscular rigidity or occasional convulsions. This is particularly true in infantile and other cases of basilar meningitis. The location and extent of the inflammatory process is far more important in determining the symptoms in any given case than is the character of the exudate, but the symptoms are all very largely influenced by the etiology of the case. In all cases, therefore, the previous history is of the utmost importance in order to enable us to attach due significance to the symptoms actually present.

The symptoms of *acute basilar leptomeningitis* depend upon the amount and distribution of the inflammatory exudate, which may involve any of the cranial nerves, thus giving motor, sensory, and special sense disturbances, deepening very often into paralysis of all their functions. Disturbances of

sight, hearing, smell, and taste are common. Pain is usually confined to the head, face, and upper spinal regions. Ptosis and strabismus are frequent symptoms. According to Ott, very rapid respiration is indicative of involvement of the tuber. There is commonly retraction of the head, and often more widespread spastic conditions of the muscles. In nearly all cases fever is present, and may be of a severe type, but more commonly it is of moderate grade, and may be entirely absent in cases occurring among emaciated children in poor surroundings. When hydrocephalus occurs as a result of the inflammation, the spastic muscular condition is succeeded by more or less general paralysis, due to the increased intracranial pressure, which may directly or indirectly affect the motor areas. A fairly-common symptom preceding death is Cheyne-Stokes respiration, which may, however, appear quite early in the disease, and be present continuously or intermittently until the termination of the case. It is also common in other varieties of meningitis.

The symptoms of *acute cortical meningitis* are more markedly motor in character than in basilar meningitis, and cranial nerve-disturbances and palsies are not present, unless the base is also affected. It must be remembered that quite frequently cortical and basilar meningitis are associated. The chief distinctive features of cortical leptomeningitis are due to involvement, by pressure or irritation, of the motor areas underlying the portion of the membranes affected. Thus, we may have localized spasms of the arm or face and tongue; motor aphasia either partial or complete; convulsions, which may be Jacksonian or general in type; and varying forms of paralysis, according as more or less of the motor zone is involved. Optic neuritis is not so common as in basilar meningitis. In the early stage of the disease active delirium is often present in severe cases, giving way quickly, however, to apathy, stupor, and coma as the disease progresses and the exudate increases in amount. The foregoing statement of the symptoms observed in cases of acute leptomeningitis applies to all cases of the disease, except that, according to the special pathological or etiological variety of the disease, they are divided into many clinical groups; all of which, however, partake of the same general characteristics. The symptoms of the chief clinical varieties met with will now be briefly given.

Simple Acute Leptomeningitis (Cerebral).—This form of acute leptomeningitis occurs in infancy and early childhood. Prodromic symptoms are few or entirely wanting. The patient may exhibit some restlessness or irritability for some days before the disease actually begins. The onset is usually sudden, with fever, vomiting, headache, delirium, and often early and repeated convulsions. The fever is commonly decided and ranges from 102° F. to 105° F. during the first few days. In very violent cases coma comes on early and often with very few previous symptoms, and is attended by rigidity of the cervical muscles, and also frequently of one or all of the limbs. The pulse is rapid at first, but usually becomes slower after some days, and is again more accelerated later, when it is apt to be intermittent. The pulse in these cases is subject to the greatest variations, and may be either abnormally slow or fast, but it almost always is deficient in tension. There is usually hyperæsthesia of the sight and hearing. The pupils are contracted at first, or irregular in size, and as the disease progresses both may be equally dilated.

The muscular soreness in these cases is often extreme, the slightest pressure anywhere over the body causing acute pain. Finally all of the senses are obtunded and a condition of complete coma with persistent muscular rigidity results. This rigidity may affect only the cervical muscles, but more commonly it is more widespread, and affects the limbs. The *tache cérébrale* is present. As death approaches, muscular paralysis is more pronounced, the patient has spells of collapse, Cheyne-Stokes respiration often is present, the sphincters relax, and death occurs in from a few days to a few weeks from the beginning of the illness. In those cases which recover the invasion is commonly less abrupt, the fever of lower type, and all of the symptoms less severe. It is probable that some of the cases, which from lack of information we must classify as cases of simple leptomeningitis, really owe their origin to infection which cannot be traced. The number of cases of purely simple character is small compared with the larger class in which direct or indirect infection is the causative agent.

The same symptomatology practically applies to all of the acute infantile cases, although the cases differ much in severity and duration.

Acute Tubercular Leptomeningitis.—This form of the disease is clinically the most important since it is that most commonly met with.

The clinical history of tubercular, or basilar, meningitis, as it is more commonly called, differs in some particulars from the class of cases above described, but these differences are by no means sufficient to enable us to always positively differentiate them. The prodromal signs of the disease are usually much more prolonged than in cases of simple leptomeningitis. For a week or two the patient is noticed to be unwell. The symptoms during this period vary a great deal, but include restlessness, peevishness, mental apathy or irritability, and disturbed sleep, transient headache, coated tongue and impaired appetite, and occasional vomiting, and a decidedly pale or cachectic color of the skin. Rarely these symptoms are not observed and the onset may be acute. Soon fever makes its appearance and rises progressively, with morning remissions, ranging from 99° to about 101½° F., although the evening temperature may be much higher early in the course of the disease. Succeeding this prodromal period more decided and characteristic signs slowly develop. These are irregularity of the pulse, which has already been accelerated in correspondence to the degree of the fever present; irregularity of respiration, with retraction of the abdomen: dilatation of one or both pupils, with slow lateral movement of the eyes; and heightened fever at night, with local flushings of the face. Following these or accompanying them are slight or decided facial twitchings or a general convulsive seizure. Some form of paralysis soon develops. This may be ptosis, strabismus, amaurosis, facial paralysis, or hemiparesis, or hemiplegia. The temperature still ascends, opisthotonos is marked, the abdomen is greatly retracted, and Cheyne-Stokes respiration often precedes death, which commonly occurs within four or five weeks. The ophthalmoscope sometimes reveals tubercles of the choroid.

> Case of a boy, 17 years old, the victim of acute miliary tuberculosis, who was affected with a spasmodic condition of the right hand resembling athetosis, and who also had left hemiparesis. Diagnosis made of tubercles in the external part of the thalamus and the posterior part of the internal capsule. The autopsy con-

firmed the diagnosis, but also showed tubercles in the upper right ascending frontal convolution. Ewald (Gaz Hebd. de Méd. et de Chir., May 2, '91).

Tubercular meningitis presents no symptoms during the onset. The only sign is a disharmony,—viz., an irregularity (dissociation) of the respiratory movements of the diaphragm and the thorax, which sets in during the first days of meningitis. Simon (La France Méd. et Paris Méd., Mar. 29, '95).

Tubercular Cerebro-Spinal Leptomeningitis. — Cases of tubercular cerebro-spinal meningitis have been studied by Hayem, Moxon, Magnan, Shaw, Liouville, Eskridge, Mills, and others. It is, however, a comparatively rare affection, and when it does occur it is usually in the course of generalized tuberculosis. According to Eskridge, the tubercular deposits may occur first in the spinal membranes; but more commonly the cerebral and spinal membranes are affected together. In the case studied by Eskridge and Mills and referred to by the latter in his work on nervous diseases, the patient was 16 months old, and presented the following symptoms: "Headache, lateral movements of the head, temperature of 103° F.; pulse, 150; respiration, 84; and tetanic convulsions, with some imposed clonic movements, and rigidity of the limbs" (Mills). This case ran a course of eight months. The post-mortem diagnosis of tubercle could not be made macroscopically in the case, but was established beyond question by an expert microscopist. The symptoms observed in such cases necessarily will depend upon the mode of development, and upon the relation between the spinal and encephalic tubercular lesions.

Epidemic Cerebro-Spinal Meningitis.—This form of leptomeningitis is a specific infectious disease, but presenting as its chief pathological lesion a widespread inflammation of the meninges of the brain and spinal cord. It has been recognized as such for nearly one hundred years. Other names sometimes used are "spotted fever," "petechial fever," and "malignant purpuric fever." It occurs as a sporadic epidemic or endemic disease, and varies much in malignancy in different epidemics. (*a*) A very malignant form is described in which death often occurs before the exudate has time to appear. The symptoms in this malignant variety are sudden onset, with chills, pain in head, extreme physical and mental depression, local or general muscular spasms, fever of 102° to 103° F.; feeble pulse, becoming slow; purpuric rash (not constant) and death inside of twenty-four hours, or even less, as in a case recorded by Stillé, in which death occurred within ten hours.

Case of leptomeningitis lasting only six hours. First symptom was a slight convulsion, laryngeal obstruction simulating croup; high temperature, 106.5° F. to 107.6° F.; absence of vomiting. There had been no prodromata. Autopsy showed a dry, glazed brain, with adhesion between the gyri and between the hemispheres; the vessels of the pia were injected. No pus or tubercles. Other organs normal. Hosmer (Boston Med. and Surg. Jour., May 17, '88).

Case of meningitis of unknown origin, ending fatally quite suddenly, with sharp elevation of temperature from normal to 105° F. in less than two hours, coma, abolition of all reflexes and of respiration, and apparent death, though the heart continued to beat and the pulse to be perceptible for thirty-eight hours afterward, artificial respiration being practiced almost continuously meanwhile. Smith (Va. Med. Mthly., Oct., '93).

(*b*) The ordinary form also begins suddenly, with few premonitory symptoms, with a chill, severe headache, repeated attacks of vomiting, and moderate fever. Very early there is rigidity of the poste-

rior cervical muscles, causing severe pain. There is photophobia and hypersensitiveness to light and noise. Often there is severe pain in the limbs and back. Tonic and choreic spasms of the limbs occur, and, in young children, general convulsions are more common than in older children or adults. Strabismus, followed by paralysis of the eye-muscles, with involvement of the facial muscles, frequently occurs. During the early stage delirium may be a very marked feature, but soon the patient sinks into a stuporous condition, but often continues to suffer from the severe head-pains and body-pains until the stupor becomes coma. The disease is very irregular in its course, remissions are frequent in all its symptoms, and the fever especially is apt to be most variable.

The respiration is not apt to be so much disturbed as in tubercular meningitis. The pulse is often extremely rapid in young children, but in older persons it may be either rapid or distinctly slow, full, and strong in the early days of the disease. The petechial rash occurs in a considerable proportion of the cases. Stillé noted its absence in thirty-seven out of ninety-eight cases in the Philadelphia Hospital. Osler states that petechial and purpuric spots were commonly present in his cases in Montreal. Other forms of eruptions noted as occurring in this disease are herpes labialis, erythema nodosum, ecthyma, and pemphigus. The spleen is enlarged, and constipation is the rule. Albuminuria, glycosuria, and hæmaturia have been observed. The disease runs a variable course from a few days to several months. Of the fatal cases a majority die within the first week. Recovery is often slow and complications are common, including pneumonia, pleurisy, pericarditis, and painful forms of arthritis in some epidemics of the disease.

Attention called to frequency of pharyngitis during epidemics of cerebro-spinal meningitis. Sears (Boston Med. and Surg. Jour., Aug. 9, '88).

Peripheral or multiple neuritis occurs in some cases of cerebro-spinal meningitis. This coincidence observed in three cases. C. K. Mills (Medical News, Mar. 3, '88).

Thirty cases of cerebro-spinal meningitis in an epidemic. In 17 cases the most striking symptom was herpes, several of these cases dying. In 11 cases the urine contained albumin, but no casts; in 2 cases there was polyuria, and in 1 glycosuria, the patient dying on the fourth day. Früs (Univ. Med. Jour., July, '93).

Case of cerebro-spinal meningitis in which persistent hæmaturia was present. Biggs (Epitome of Med., Aug., '93).

Case of boy who died of cerebro-spinal meningitis, which apparently originated in trauma. Remarkable features of the case were persistent coma for two weeks and phenomenal emaciation. Thompson (Med. Record, Apr. 8, '93).

Eye-symptoms studied in epidemic of cerebro-spinal meningitis. Various affections noted with more or less frequency are conjunctivitis, altered pupils, pus in the anterior chamber, choroiditis and iritis, suppurative cyclitis, retinitis, panophthalmitis, neuritis, etc. The fundus should always be examined, as there is a direct communication between the arachnoid space and the deeper structures of the eye through the intravaginal space.

Of 35 cases, 21 fatal. Case of child, aged 20 months, in which there was thrombosis of the central vein with an hæmorrhagic retinitis. The fundus was normal in only 7 cases, and 1 of these 7 had divergent strabismus and dilated pupils, another marked nystagmus, and another greatly dilated pupils. In 6 cases there was optic neuritis, and in 19 great venous engorgement and tortuosity, with congestion of the optic disk. Of the 3 cases in which there was an absence of all eye-symptoms, 2 recovered and 1 died. All cases of strabismus (8) were divergent, and the right eye was always affected. Every extensive epidemic is apt to be associated with a special type of

eye disease. Randolph (Johns Hopkins Hosp. Bull., June, July, '92).

Literature of '96-'97-'98.

Many of the eye-symptoms of importance in meningitis are largely motor. Thirty-eight cases of meningitis reported —13 simple leptomeningitis, 12 cerebro-spinal meningitis, 13 tuberculous. In 8 of the 13 cases of leptomeningitis there were no eye-symptoms. The patient with purulent meningitis, in which no eye-symptoms were present, showed, post-mortem, the meninges covered with pus and extensive adhesions between the pia and dura mater. In the cases of cerebro-spinal meningitis eye-symptoms were absent in 7. Loss of iris-reflex was present in 1, dilated and fixed pupils in another, strabismus in a third, and in the fourth the pupils were dilated, but reacted to light.

No eye-symptoms were present in 8 of those having tuberculous meningitis. Cerebro-spinal meningitis has as prominent symptoms paralysis of third, fourth, ophthalmic division of fifth, sixth, and seventh nerves, with nystagmus and ptosis from cortical lesions; choked disk, optic neuritis, perineuritis, plastic and suppurative iritis, conjunctivitis, œdema of the lids, hemianopsia as a cortex or tract lesion. In simple meningitis or leptomeningitis the eye-symptoms are of more importance in determining the diagnosis than in the cerebro-spinal type. The most reliable is optic neuritis. A. E. Davis (Med. News, June 5, '97).

The sequelæ include blindness, deafness, chronic hydrocephalus, severe neuralgias of the head, and mental disease of various types.

Syphilis may very rarely cause an acute cerebral leptomeningitis, but it is much more commonly a cause of chronic leptomeningitis. The symptoms do not differ from other varieties of acute leptomeningitis, excepting for their association with other evidences of syphilis, such as gummata or specific ulcerations of the bones.

Literature of '96-'97-'98.

In acute syphilitic meningitis extremely-intense headaches, repeated vomiting, and occasional elevation of temperature are the first symptoms. If the process be at the base, vertigo, mental troubles, symptoms of compression of the cranial nerves, polyuria, and bulbar phenomena supervene, and profound depression succeeds, ending in fatal coma. If the convexity be chiefly affected, phenomena of excitement predominate; noisy delirium, repeated convulsions and hallucinations. Coma comes on later—often with hemiplegia or monoplegia. Specific treatment is of no use in these acute cases. Teissier and Roux (Treatment, Mar. 10, '98).

Traumatic Leptomeningitis. — The symptoms present in cases of fractures, concussion of the brain, or perforating wounds of the skull are, from the nature of these injuries, often of a mixed character, depending upon the extent and severity of the traumatism, and whether there is also injury to the brain-substance. Under these circumstances the leptomeningitis occurs as a complication of the injury, and presents no special symptoms other than those already referred to as common in all cases of the disease. These will depend for their intensity and grouping upon the position and extent of the inflammation, and will be mingled with those of the injury itself.

Diagnosis. — It is necessary to distinguish the various types of acute leptomeningitis from each other, from encephalitis, from the meningeal symptoms of the continued fevers, acute rheumatism, pneumonia, tetanus, cerebral tumor and abscess, uræmia, the hydrocephaloid disease of Marshall Hall, and hysteria.

In meningitis when tubercle, otitis, trauma, syphilis, and other well-known causes are not present, the probability is that the micro-organism of the epidemic variety is the cause, the case being a

sporadic example of cerebro-spinal meningitis. Idiopathic cases are characterized by the following points: (*a*) Both brain and spinal cord are frequently attacked, and spinal symptoms are common; these symptoms are rare in other varieties of meningitis which attack both brain and cord. (*b*) The duration of illness varies from one to four weeks, the variation depending mainly on the stage of the disease at which the cerebral membranes become affected. (*c*) Recoveries are fairly frequent. (*d*) The best treatment seems to consist in the administration of mercury and iodides. (*e*) The affection of the cerebral membranes may be either at the vertex or the base or both. (*f*) The cases occur perhaps most frequently in the cooler parts of the year. There is some evidence for considering these cases to be associated with epidemic meningitis and for considering that the cause of both may be diplococcus pneumoniæ. Bottomley (Practitioner, June, '94).

Acute leptomeningitis, either purulent or sero-purulent, is separated from cases of so-called serous leptomeningitis (external hydrocephalus) chiefly by the greater frequency of the former, the more prolonged and milder course usually of the latter affection, and, as advised by Quincke, by lumbar puncture. If the fluid obtained has a specific gravity of 1009 or less, and contains more than two parts of albumin per thousand, Quincke regards it as hydrocephalic fluid. Fever is slight or absent in serous meningitis and choked disk is more common than in acute purulent or suppurative meningitis (Mills). The diagnosis of the serous meningitis described by Quincke from certain cases of tubercular leptomeningitis is impossible unless there is a distinctly tubercular history obtainable.

Literature of '96-'97-'98.

Lumbar puncture is a valuable aid to diagnosis, and it has a probable therapeutic indication in serous and sero-purulent meningitis, likewise in chlorosis with marked cerebral manifestations. Bertram W. Sippy (Deut. med. Woch., June 10, '97).

Simple acute purulent leptomeningitis of the basilar type differs from tubercular basilar leptomeningitis by its more abrupt invasion, the absence of signs or history of tuberculosis, and tendency to higher range of temperature; while prodromic symptoms, with more irregular course, temperature, and pulse, and possibly choroidal tubercles, are common in the latter affection.

Epidemic cerebro-spinal leptomeningitis is distinguished from the other varieties by the presence, in the vicinity, of other cases of the disease; its very sudden onset with severe rigors and marked pains in back and limbs; its spinal symptoms, the presence of its skin eruptions, and by the alarming intensity of all the cerebral and spinal symptoms, and the rapidity with which they attain their maximum. The sporadic cases of the same disease run a less acute course, are of extremely rare occurrence, and are much more liable to be confounded with one of the continued fevers presenting grave nervous symptoms.

Literature of '96-'97-'98.

Results of the bacteriological examination of fluid obtained by lumbar puncture in four cases of epidemic meningitis. In all the cases the meningococcus intracellularis of Weichselbaum was found in the fluid. The fluid obtained by puncture was centrifugated, and from the sediment cover-glass preparations were made in the usual way and stained according to Loeffler. In all the preparations numerous leucocytes were found, in which were often seen three or four pairs of cocci. The diplococci were very like gonococci in appearance, and lance-shaped diplococci were not found. Pure cultures of the meningococcus were obtained upon glycerin agar-agar in each case.

By this method a diagnosis can be easily made in epidemic meningitis by lumbar puncture, and a differential diagnosis during life between it and tubercular meningitis. W. Holdheim (Deutsche med. Woch., No. 34, '96).

In cases of meningitis of doubtful diagnosis lumbar puncture is of great importance. The operation consists in withdrawing cerebro-spinal fluid from the lowest part of the vertebral canal by means of a puncture carried through the ligaments connecting the lumbar vertebræ. A hollow needle with trocar and cannula, or an hypodermic needle may be used; but it is better not to aspirate. Following method recommended: The child is placed upon its right side, with the thighs so bent that it lies curled up, with the vertebral column well bowed. In those suffering from cerebral irritation, in the restless, and in those who are not yet unconscious, it is necessary to give an anæsthetic. The exact position of the patient is unimportant, so long as the vertebral column is kept convex at the seat of puncture from the time the needle is inserted until it is withdrawn.

The skin over the lower part of the back is well washed with soap and water, dried, and sponged with a solution of corrosive sublimate (1 in 2000), while the trocar and cannula of the smallest hydrocele size is sterilized by boiling in a test-tube for three minutes. To find the most suitable point for puncture a perpendicular is dropped upon the bed from the highest point of the crest of the ilium (the patient being on the side), for this line crosses the upper border of the spine of the fourth lumbar vertebra, and thus marks the position for puncture. The trocar and cannula are plunged through the skin immediately to one side of the spine of the third lumbar vertebræ, and on a level with its lower border. It is pushed on boldly until the point of the trocar touches bone—the lower border of the lamina. The handle of the trocar is then directed upward, so that its point passes downward over the lamina. It is then pushed onward until a grating sensation is felt.

It is important to see that the end of the cannula is well beveled and fits closely to the neck of the trocar. The trocar is withdrawn as soon as it is felt that it has fairly entered the subarachnoid space, care being taken that the cannula is not at the same time pulled out of the vertebral canal. D'Arcy Power (Clin. Jour., May 20, '96).

In lumbar puncture as a means of diagnosis in epidemic cerebro-spinal meningitis a small trocar of some strength should be used, and should be inserted downward and inward at a point slightly lower than the lowest point of the spinous process of the second lumbar vertebra, and one inch outside. It should penetrate to a depth of rather more than two inches. These measurements are for adults. The pus is often thick and flows with difficulty. Williams (Boston Med. and Surg. Jour., Sept., '97).

Following conclusions reached, regarding the value of lumbar puncture: 1. Tapping, as a diagnostic or therapeutic adjunct, is quite worthless, according to personal experiments, but other investigators have discovered in the cerebro-spinal fluid proof positive of the tubercle bacillus. 2. In acute cases of meningitis cerebro-spinalis the cerebral fluid does not contain morbid products which, if applied to animals, may serve to verify clinical observation. 3. When the acute stage has been passed and hydrocephalus is present, no diagnostic assistance can be obtained from the examination of the fluid. 4. As a therapeutic agent is equally inefficacious in meningitis cerebro-spinalis and meningitis tuberculosa, but individual cases do improve when operated on early, often repeated, and large quantities abstracted. Monti (Med. Press and Circ., Dec. 1, '97).

Case of cerebro-spinal meningitis in which the diagnosis was confirmed by finding the diplococcus of Weichselbaum in the meninges at the necropsy. James B. Herrick (Jour. Amer. Med. Assoc., July 2, '98).

Following conclusions reached from study of epidemic of cerebro-spinal meningitis: 1. There is no constant and definite relation between the severity of the symptoms and the degree of turbidity of the spinal fluid. 2. There is little or no connection between the number of organ-

isms and the number of cells present in the spinal fluid. 3. In many cases there appears to be but slight connection between the number of organisms found in the spinal fluid and the severity of the disease. 4. Unless the subsequent examination of the spinal fluid is carefully performed no deductions as to the presence or absence of meningitis are justifiable. A. H. Wentworth (Lancet, Oct. 1, '98).

Attention called to sign given by Kernig for diagnosis of meningitis: personally found in 41 out of 46 cases.

The patient is examined first in the dorsal decubitus and then sitting. In the first position it is very easy for the patient to extend the leg completely; in the sitting posture, however, the leg can no longer be extended completely. In very marked cases it cannot be extended beyond 90 degrees, and in all cases not beyond 135 or 140 degrees. But as soon as the patient lies down, complete extension is again easy. This phenomenon has not been met with outside of meningitis. Netter (Le Bull. Méd., July 24, '98).

The diagnosis of leptomeningitis of the vertex from the basilar form is made by the great prominence of motor involvement, and the active delirium and abnormal cerebration in the early days of the disease in cases of the former; with absence of the symptoms of cranial-nerve irritation or paralysis. As remarked by Osler in his "Practice of Medicine," the signs of cortical leptomeningitis cannot be separated clinically from the symptoms present at times in pneumonia and other general diseases, and due to simple congestion of the pia mater, unless there is also present some positive sign of leptomeningitis due to coincident or subsequent involvement of the cranial nerves by extension of the inflammation to the base of the brain.

The diagnosis between acute leptomeningitis, typhoid fever, or any of the acute specific fevers is made by a careful review of the history of the illness, the presence or absence of the eruptions of the various fevers, and by the presence of cranial-nerve spasm or palsy, optic neuritis, or of monoplegia or hemiplegia in cases of leptomeningitis.

From BRAIN-TUMOR the diagnosis of subacute cases of leptomeningitis may be exceedingly difficult. The two conditions may co-exist, and the same may be said of cerebral abscess, which is not infrequently associated with purulent leptomeningitis, or finally all three conditions may be present in the same case, as in a case seen by the writer in which several calcareous growths between the dura and arachnoid pressed deeply down through the post-parietal region to the lateral ventricle, into which an abscess, formed about the tumor, finally discharged. The autopsy showed an extensive cortical purulent leptomeningitis over the vertex, and its development with rupture of the abscess at the lateral ventricle was the immediate cause of death. Usually, however, in cases of brain-tumor, its symptoms are more regularly progressive, the pain more definitely localized, and the pressure-symptoms more clearly defined than is the case in leptomeningitis, while there is rarely such variations of pulse and temperature as are commonly present in the latter affection, and optic neuritis is more common in brain-tumor.

Certain cases of URÆMIA may resemble some types of leptomeningitis. Here the careful and repeated examination of the urine, the presence of some form of œdema or dropsy, the possible presence of albuminuric retinitis, and a careful study of the previous history of the case will suffice to establish the diagnosis. Much more frequently uræmia has a clinical resemblance to brain-tumor.

Literature of '96-'97-'98.

Four cases in which the differential diagnosis between uræmia and meningitis

was extremely difficult. First patient had paralysis of the muscles of the left eye and complete right hemiplegia, excepting the upper branch of the facial. At autopsy there was some œdema of the brain, but no lesions and a diffuse pyelonephritis. Second case presented paralysis of the muscles of the left eye and the lower branch of the right facial. There were hyaline and granular casts and considerable albumin in the urine. No cerebral lesion was found. Third case had no nervous symptoms excepting coma. The urine was heavily loaded with albumin; nevertheless the kidneys were negative, but a profuse purulent infiltration was found over the base and convexity of the brain. Fourth case presented the symptoms of delirium tremens. The urine was albuminous. Suddenly focal palsies occurred in both eyes, but at the autopsy only the kidneys were diseased. A. R. Edwards (Amer. Jour. Med. Sci., Aug., '96).

Tubercular leptomeningitis may be confounded with the HYDROCEPHALOID DISEASE first described by Marshall Hall. This disease occurs in young children as a result of disease or of extremely bad conditions of life. It is characterized by intense cerebral anæmia, and the child passes through a cycle of symptoms closely analogous to adynamic cases of leptomeningitis. It often follows chronic diarrhœa. It is distinguished from the inflammatory conditions by absence of marked fever, of rigidity of the neck-muscles, and of any cranial-nerve or cortical palsies: while under treatment by stimulants, suitable food, hygiene, and tonics, the condition is often readily curable.

Differential diagnosis between syphilitic and tubercular meningitis: The latter is rare under 1 year of age: the former may occur very soon after birth. In the tubercular form paralysis seldom opens the scene, while it is often an initial symptom in the specific form. In the latter form there is often apyrexia instead of fever; the opposite condition prevails in tubercular meningitis. In specific cases the cry is rather plaintive, and differs from the true hydrocephalic cry. The pulse is often irregular, but the typical slow pulse of tubercular disease is not observed. Respiration in the specific cases is not so often affected with irregularity, and is very rarely of the Cheyne-Stokes type. The retraction of abdomen, vomiting, constipation, delirium, contractures, peculiar posture, rapid wasting, and the munching belong more properly to the tubercular cases. Stoeber (L'Union Méd. du Canada, Aug., '91).

Literature of '96-'97-'98.

Distinct form of meningitis recognized, occurring almost exclusively in infants. Description of this disease is based upon eleven cases, all of which occurred in previously-healthy infants under a year old.

The onset is gradual in some, sudden in others; but, in all, the most constant and characteristic symptoms are severe vomiting, extreme head-retraction, and stupor, passing into coma, of remarkably long duration, generally several weeks,—the excessive head-retraction persisting to the last.

The cases reported all terminated fatally, none in less than five weeks, while some children lived for three months or even longer. At the autopsies inflammation of the pia and arachnoid was found over a very definite area at the basis of the brain, hydrocephalus in all the cases, and, in some, closure of the openings between the fourth ventricle and the subarachnoid space. In no instance was any sign of tubercular disease discovered, either in the cranial cavity or elsewhere. J. W. Carr (Med. Week., Apr. 16, '97).

Tubercular leptomeningitis and TYPHOID FEVER may present very similar clinical appearances. The former, however, has retracted abdomen, constipation, normal or only slight splenic enlargement, local or general spasms or paralysis, a generally lower temperature, more frequent *irregularity* in the pulse, respiration, and temperature, and the ab-

sence of any pathognomonic eruption, to distinguish it: besides the history of the case which may aid materially in forming an early diagnosis, in cases in which no visible signs of other tubercular lesions are observed.

In typhoid the knee-jerks are altered: but the alteration is constant. They are always exaggerated, and ankle-clonus may be present. In tubercular meningitis the jerk is either absent or unequal on the two sides, or present on one side and absent on the other. Angel Money (Australian Med. Gaz., June 15, '94).

Tubercle bacilli found in removed cerebro-spinal fluid in twenty-seven out of thirty-seven cases, proving presence of tuberculous meningitis, afterward verified. Fürbringer (Berliner klin. Woch., No. 13, '95).

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Thirty-two cases with sixty lumbar punctures. There was no unpleasant after-effect, and this was chiefly to be ascribed to the fact that the puncture was practised with the patient on his side, and that only one case of cerebral tumor was thus treated. There were 3 cases of epidemic meningitis, 2 of which were fatal. There were seven cases of tuberculous meningitis all fatal. Lumbar puncture was here often of diagnostic value. Only twice was the tubercle bacillus found, but the fluid presented in general characteristic appearances. It was clear or only slightly opalescent, contained an increased amount of albumin, and was more or less rich in cells. In 4 cases the diagnosis of serous meningitis (Quincke) was made. The nature of a case of hæmorrhagic pachymeningitis was made certain by this procedure. In the remaining cases lumbar puncture did not assist the diagnosis, and it had no clear therapeutic effect. These cases included apoplexy, cerebral tumor, uræmia, cerebral syphilis, etc. Spinal puncture is a valuable extension of our means of diagnosis, and some therapeutic value is probable in cases of serous and sero-purulent meningitis, as well as in the cerebral disturbances of chlorosis. Thiele (Brit. Med. Jour., from Deut. med. Woch., June 10, '97).

Diagnosis of tubercular meningitis by lumbar puncture studied diligently in Heubner's clinic in Charité for the space of a year. Nineteen cases being observed. The bacillus was found in every instance. Negative results reported by others must necessarily have been due to imperfect technique. In three instances where the microscope did not reveal the bacillus positive results obtained by inoculation. Method was that of Quincke, whose apparatus for puncture was made use of. The operation is entirely harmless. Slawyk (Berliner klin. Woch., May 2, '98).

Emphasis laid on the Skeer sign, which, when present, will enable a diagnosis of tuberculous meningitis to be made very early. It is dependent on the deposition of tubercles around the pupillary margin of the iris, showing itself first as a distinct wreath of white clouds about a millimetre from the margin. This sign occurs before any change has taken place in the size of the pupillary orifice. After three or four days these minute cloud-like masses disappear, and a yellowish brown circle takes their place, becoming more and more attenuated as the pupil dilates. D. R. Brower (Brit. Med. Jour., July 9, '98).

Etiology. — Acute leptomeningitis arises from, and is associated with, very many pathological conditions. In a certain proportion of cases the causal factor is entirely obscure and no local or general source of infection can be found. Usually, however, the disease is due to infection of the membranes with pathogenic micro-organisms, and very often the source is apparent or can be easily inferred.

The chief causes giving rise at times to acute leptomeningitis may be enumerated as follows:—

1. Tuberculosis.
2. The specific poison of the epidemic cerebro-spinal meningitis.

3. Suppurative aural or nasal disease, caries of the cranial bones.

4. The diarrhœal and dysenteric diseases of infancy and childhood.

5. The acute general diseases, — including pneumonia, erysipelas, influenza, scarlet fever, ulcerative endocarditis, diphtheria, pertussis, rheumatic fever, septicæmia, pyæmia, and possibly typhoid fever.

6. Traumatism, surgical operations, and sun-stroke.

7. The syphilitic, gouty, and rheumatic diatheses.

8. Sclerosis of the blood-vessels, miliary aneurism, embolism, intracranial tumor and abscess, and nephritis at times influence its development; and, in children especially, marasmus and poor conditions of life powerfully predispose toward some grade of leptomeningitis.

The above-mentioned conditions are all at times either predisposing or exciting causes of acute inflammation of the arachnopia. A large majority of the cases of basilar meningitis in infants and children is due to tuberculosis. Most of the cases arising from necrosis or suppuration about the head arise from necrosis of the petrous portion of the temporal bone and middle-ear suppuration. Cases also arise by infection from the nose; the infection gaining access to the ear by way of the Eustachian tube, and thence to the pia by way of the blood-vessels or lymphatics.

Of thirty-two cases of tubercular basilar meningitis twenty-four were secondary to chronic disease of the lungs, which was clinically recognizable. No case recovered. Herman Rieder (Münch. med. Woch., Dec. 3, '89).

Tubercular meningitis in children, is, in all probability, always secondary in its cerebral development to a primary focus elsewhere, and not idiopathic. Simon (Revue Men. des Mal. de l'Enfance, June, '93).

Epidemic, observed at Asheville, North Carolina, prevailed from January to the end of March, producing one hundred and twenty-five cases. Not one of the ninety-nine cases of which notes were taken lived on high, well-drained ground. Nearly all of the cases occurred in families using well-water. In 68 per cent. of cases the sanitary condition of the dwelling was bad, in 22 per cent. fair, in only 10 per cent. good. Meriwether (N. C. Med. Jour., July, '88).

Cerebro-spinal meningitis is practically an autoinfection from the micrococcus lanceolatus, which, ordinarily innocuous and normally present in the mouth, is rendered virulent by extraneous causes which chemically alter the bodily secretions. Flexner and Barker (Johns Hopkins Hosp. Bull., June, July, '93).

In 60 to 70 per cent. of recorded cases of cerebro-spinal meningitis Fränkel's diplococcus lanceolatus found. Out of ten cases, two in which there was definite pus-formation, diplococci present in enormous numbers; in those in which only fibrinous exudation existed microorganisms scantier and found inside the nucleus of the cells. The "diplococcus intracellularis" the true cause of epidemic cerebro-spinal meningitis. Jaeger (Zeit. f. Hyg. u. Infects., B. 19, H. 2, '95).

Seven cases of pseudomeningitis, six fatal, without anatomical lesions, following an epidemic of influenza. Krannhals (Deut. Archiv f. klin. Med., Dec. 20, '94).

Epidemic of cerebro-spinal meningitis which affected children only. There were forty-three cases in a total population of about two hundred and fifty people. Origin of the epidemic was traced to the village-school, where it was learned that a few weeks previously a number of the children had been affected with a sharp diarrhœa. The same children affected with meningitis had been victims of the preceding diarrhœa. Disinfection and closing of the school temporarily caused a cessation of the epidemic. Monk (Brit. Med. Jour., July 30, '92).

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Bacteriological examination of the meningeal exudate in a case of cerebro-spinal meningitis showing, in the pus-

cells, a special diplococcus distinguished from that of Fränkel by a globular form and a frequent disposition in fours, by its not staining by Gram's method, and by the difficulty of causing infection in animals when subcutaneously inoculated. Kischevski (La Méd. Mod., Jan. 8, '96).

Although the organisms are much alike, the meningococci vary more in size among themselves than the gonococci. The arrangement in the cells is much alike in both cases. Both decolorize by Gram's method. The meningococci, however, grow rapidly in glycerin agar: a fact of great value in the diagnosis of cerebro-spinal meningitis by the aid of spinal puncture. It was impossible to inoculate guinea-pigs and rabbits, but, while carrying on the observations, the operator had rhinitis, with marked depression, headache, nervousness, and a drawing pain in the neck. The pus from the nose showed cocci similar to those in the cultures and these soon overcame the other bacteria of the nose, appearing almost in pure culture. F. Kiefer (Berliner klin. Woch., No. 28, '96).

Case of rapid death after labor from infectious meningitis from the pneumococcus. Crouzat (Rev. Obstet. Internat., Apr. 21, '97).

Case of epidemic cerebro-spinal meningitis in a girl, aged 2 ½ years, terminating in recovery at the end of thirty-four days. Lumbar puncture was made and the cerebro-spinal fluid gave a pure culture of the intracellular meningococcus (Weichselbaum-Jaeger), which, according to the researches of Heubner, should be considered the specific cause of epidemic cerebro-spinal meningitis. Stoelzner (Berliner klin. Woch., No. 16, '97).

The pneumococcus and meningococcus are the chief producers of cerebro-spinal meningitis, and other micro-organisms, especially the pyogenic cocci, play the causative part in only a few cases. In circumscribed meningitis the pneumococcus has, up to the present, alone been found. A general infection by way of the blood must be distinguished from a local infection arising from some region in the neighborhood of the skull. One of the most frequent modes of infection is the micro-organisms' gaining access from the naso-pharynx through the Eustachian tube into the middle ear, and thence into the cranial cavity. Wolf (Berliner klin. Woch., Mar. 8, '97).

Epidemic cerebro-spinal meningitis is to be classed among the contagious diseases, belonging to the same category as phthisis pulmonalis. Unsanitary conditions exert great influence in affording a proper *nidus* for the growth of the germs of this disease. William J. Class (Med. News, Dec. 3, '98).

One hundred and eleven cases of epidemic cerebro-spinal meningitis examined. Conclusions are as follow: Epidemic cerebro-spinal meningitis is an acute infectious disease produced by a micrococcus characterized by its growth in pairs and by certain cultural and staining properties. The seat of the disease is the meninges of the cord and brain. It is possible that the nose is the portal of entry. There is an acute purulent inflammation in the pia-arachnoid. The cortex is affected by extension. The cord is always affected. The organisms are found in considerable numbers in the majority of acute cases. The surest method of diagnosis is by spinal puncture. In the early stage a fluid more or less clouded by pus-cells, containing the organisms can be found.

There are no prodromata; there is vomiting and pain in the head. In most cases there is pain, stiffness, and muscular contraction of the neck. There is usually delirium, and in many cases unconsciousness passing into coma. Paralyses are common. Councilman, Mallory, and Wright (Report State Board of Health of Mass., '98).

The disease of infancy, recently described as simple or non-tuberculous posterior basic meningitis, is a specific disease, due always and only to a particular micro-organism. The micro organism which is the cause of this disease is a diplococcus almost identical with the diplococcus described by Weichselbaum and Jaeger; it presents, however, some slight differences, which are probably to be accounted for by natural variation.

The simple posterior basic meningitis of infants must, on bacteriological evidence, be considered as a sporadic form of the disease known as epidemic cerebro-

spinal meningitis, the D. intracellularis having been shown by recent observers to be the cause of some, at least, of the epidemics of that disease. The periarthritis, which occasionally complicates posterior basic meningitis of infants, is due to the same diplococcus that is found in the meningeal exudation. G. F. Still (Jour. of Path. and Bact., volume v, p. 147, '98).

Case of boy of 13, who for several days presented all the clinical signs and symptoms of tuberculous meningitis. The boy then passed seven worms and all the symptoms disappeared instantly.

Another case of a boy of 7, who also presented all the symptoms of tuberculous meningitis. An emetic was given, then calomel and santonin, which brought out several worms. Nevertheless the condition of the child continued to grow worse, the meningitis took its regular course, and the child died. Duchesne (Jour. de Méd. et de Chir. Prat., 24, VI, '98).

Pathology.—The post-mortem appearances in cases of acute leptomeningitis differ according to the stage of the inflammation at which the patient dies, and the character of the exudate especially is influenced by the duration of the disease. In some of the very malignant cases of cerebro-spinal meningitis intense hyperæmia of the membranes may be alone observed by the naked eye, death having occurred before the exudate had time to form. In the majority of cases, however, very marked lesions are found, with copious exudate of serum or pus, and accompanied by more or less acute hydrocephalus, especially in tubercular cases, with some degree of ventricle dilatation. Quite frequently the ependyma is found involved, and, less frequently, the brain-substance subjacent to the affected area is also the seat of inflammatory and degenerative changes, due to direct extension of the inflammatory process, and to the pressure exerted upon it by the meningeal exudate. The exudate found in these cases varies very much in color and consistency, from an almost colorless serous exudate to whitish-grayish or greenish, gelatinous pus. In cases dying before exudation can occur, the pia-arachnoid often presents large areas of brilliant-red hyperæmia. This condition may involve the entire cortex, or be unilateral, or may be chiefly at the base, with scattered patches elsewhere over the surface of the meninges. In such cases the patient undoubtedly succumbs to an intense general toxæmia, rather than to any influence produced by the local lesions within the cranial cavity. The ventricles are most frequently dilated in the tubercular cases, although in many other types of the disease this lesion is also found. When the disease is chiefly cortical or over the convexity of the brain, it is most commonly most intense over the fissure of Sylvius and over the motor convolutions. In some cases numerous opacities of the pia are present, scattered throughout the base and lateral regions of the brain, and less frequently over the cortex. About these may be collections of turbid yellowish serum, shreds of lymph, or various types of pus. In cases of long standing the pus may undergo caseation, with partial absorption of its fluid, and leave a yellowish, caseous mass upon the thickened and degenerated membranes. At the base all of these appearances may include or cover the sheaths of the cranial nerves, and often the nerves themselves are found softened and broken down. Some writers have laid stress upon a purely-serous variety of acute leptomeningitis in which there is, in addition to large ventricle, effusion or exudate of serum between the dura and the arachnopia, contained in a thin pseudomembranous new formation. Ref-

erence to this condition will be found under the remarks upon ACUTE HYDROCEPHALUS. Cases of purely-serous leptomeningitis running an acute course are extremely rare.

The great majority of cases show some degree of purulent exudate, sometimes admixed with coloring matter from the blood in severe cases of the epidemic cerebro-spinal form. Sinus-thrombosis is quite frequently found in cases arising from aural disease, sometimes associated with abscess.

In tubercular leptomeningitis of the basal membranes in infancy and childhood the exudate is frequently thick and gelatinous, while the pearly-grayish tubercles can usually be seen by the naked eye along the course of the vessels, and scattered throughout the membrane. The deposit of tubercle at the base commonly occurs over the position of the optic, olfactory, and third nerves and the crura cerebri. It may include any of the cranial nerves. In adults miliary tubercles are frequent over the cortical areas, while in children the cortex is only rarely involved. Tuberculosis of other organs in the body is usually found.

> In cortex cerebri in tubercular meningitis, as shown by the fresh method of examination, are found just under the meninges, very small round cells and also numerous flask-shaped cells which give off many fine processes, forming a mesh-work with neighboring cells. These cell-processes cannot be traced deeper than the third layer of cortical cells. The minute vessels are dilated. In many specimens the nerve-cells of the second and third layers are stunted and atrophied, often only the nucleus being left. As these degenerated nerve-cells are always in close contact with the spindle-cells, which are probably to be looked upon as scavenger-cells, it appears that the degenerate nerve-cells are taken up by them. Goodall (Brain, Summer and Autumn, '91).

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> Peculiar type described characterized by lack of caseation in the tubercles. Tendency to cicatrization of newly-formed granulation-tissue. The pia becomes indurated, giving a pathological condition more frequently seen in syphilis than in tuberculosis of the meninges. The affection seems to run a chronic and an insidious course. Busse (Medicine, Nov., '96).

The post-mortem appearances of epidemic cerebro-spinal meningitis of ordinary type are those of wide-spread acute hyperæmia, inflammation, and exudation, involving the meninges of the brain and spinal cord. The brain is engorged with blood, the veins are distended, and the membranes hyperæmic and inflamed. The spinal cord is in the same condition. The exude is sero-purulent or purulent, and grayish or yellowish in color. Sometimes it is abundant over the upper portions of the hemispheres. The pus often extends down to the extremity of the spinal cord (being more abundant in patches usually), and the whole cord may be evenly surrounded by pus. There are patches of thickening, and adhesions are found between the pia and the cortex in cases of some weeks' duration. The ventricular fluid is increased, but not to the extent common in tubercular leptomeningitis. Rarely, areas of capillary hæmorrhage and encephalitis, with softening, are found in the cerebral substance, and an abscess may be associated. The spleen is usually enlarged. Among the complications recorded by various writers are pneumonia, pleurisy, pericarditis, endocarditis, and acute nephritis.

The microscopical appearances of epidemic cerebro-spinal leptomeningitis include minute capillary hæmorrhages in the pia of the brain and cord, distended vessels with masses of leucocytes swelling their sheaths, granule-cells and red and

white blood-corpuscles infiltrating the cortical layer of brain and cord, and degenerative changes in the cells of the spinal and cerebral nerves, especially in the posterior spinal nerve-roots.

The infecting micro-organisms of leptomeningitis are the streptococcus pyogenes, the bacillus communis coli, the intracellular diplococcus of Weichselbaum, the staphylococcus pyogenes aureus, the tubercle bacillus, and the micrococcus lanceolatus or pneumococcus. The pneumococcus is now generally regarded as most closely associated with epidemic cerebro-spinal meningitis. According to Putnam, the symptoms of leptomeningitis are partly due to the absorption of toxic ptomaines formed by the micro-organisms, the other factors being the pressure of the exudate itself, and the direct pathogenic micro-organisms upon the meninges of the brain.

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Case of child, 6 weeks old, previously healthy, with the exception of a cough for a few days preceding. Upon auscultation crepitant *râles* were audible, fairly uniformly distributed. Diagnosis of acute bronchitis was made. A few days later the child was seized with violent convulsions and vomiting, passing into a semicomatose condition, and died. Purulent meningitis most marked on the vertex. No tubercles were present, the lungs were free from pneumonia, except for two small areas of congestion at the right base. The meningeal fluid contained abundant pneumococci. Ferrand (La Méd. Mod., July 8, '96).

The meningococcus behaves differently for different observers upon the ordinary culture-media, although in general it can be said to lose its vitality quite readily. It is not at all certain that the organism is really not a variety of the pneumonia. The pathological anatomy of the disease includes more or less bronchitis and hyperæmia of the lungs, with occasional areas of pneumococcic infiltration; ecchymoses in the endocardium and pericardium, with slight alteration of the heart-muscle; a small spleen, often with a wrinkled capsule. The liver is hyperæmic and darker in color. The urine often contains albumin and casts; and the kidneys are intensely hyperæmic and there is parenchymatous degeneration of the cortex. Sometimes swelling of the solitary follicles of the intestine and of Peyer's patches has been observed. Mayer (Münch. med. Woch., Aug. 30, '98).

Prognosis.—The prognosis of all forms of acute leptomeningitis is very grave. That of the simple purulent and seropurulent types, whether in infants or adults, is grave, but should always be guarded, owing to the many difficulties in the way of a positive diagnosis. The outlook in the tubercular form of the disease is wholly bad, notwithstanding the fact that a few cases have been reported in which complete recovery is stated to have occurred.

Case of tubercular meningitis in which the diagnosis was established beyond a doubt, followed by recovery. Fürbringer (Deut. med. Woch., No. 36, '94).

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With the very rarest exceptions, an attack of tubercular meningitis terminates in death. In other forms of meningitis death often occurs, but recovery is more frequent than in the tubercular form. D'Arcy Power (Clinical Jour., May 20, '96).

Two cases of meningitis, apparently tuberculous in nature, with recovery. George N. Acker (Medical News, May 29, '97).

Cases of localized or unilateral leptomeningitis in which it is possible to remove the cause by surgical operation offer hope of recovery. This applies chiefly to traumatic cases, and to some of the cases arising from suppurative aural inflammation. The syphilitic type

usually yields to prompt and energetic treatment.

In cerebro-spinal leptomeningitis, whether of sporadic or epidemic variety, the prognosis, while very grave, always admits of hope that the disease may prove abortive and recovery take place. A fair percentage of such cases recover from apparently hopeless conditions, and while the recovery may be, at times, very rapid and satisfactory, more often it is slow and protracted. In cases in which the exudate is serous, absorption may take place, and if the effusion has not been excessive in amount the brain may recover from the effects of the increased intercranial tension, and the consequent dilatation of its ventricles. The mortality of the epidemic cerebro-spinal from is greatest during the first half of the period of the epidemic, many more recoveries being recorded in the later weeks of its prevalence. Malignant cases of this disease die sometimes within a few hours after being stricken with the early disease.

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A pneumococcic meningitis is rarely recovered from, the fatal result occurring in a few days. In epidemic cerebro-spinal meningitis, on the other hand, only one-third to one-half of the cases die. The recognition of this form of meningitis by the help of spinal puncture is of considerable importance. Heubner (Deut. med. Woch., July 2, '96).

During the winter and spring of 1897 an epidemic of cerebro-spinal meningitis occurred in Massachusetts; 47 cases were treated in the Boston City Hospital. The mortality in these 47 cases was 72 per cent. Lumbar puncture was performed in a large proportion of these cases, and in most of them the diplococcus intracellularis meningitidis of Weichselbaum was found in the cloudy serum of pus obtained. Editorial (Boston Med. and Surg. Jour., Dec. 30, '97).

It is impossible to say how long an epidemic of cerebro-spinal meningitis will last or what the termination will be in a given case until the lapse of a considerable interval of time during which the patient is free from symptoms. In chronic cases the mortality is estimated to be fully as high as in the acute variety. The mortality varies very much in different epidemics. Hirsch estimates it at from 20 to 70 per cent. A. H. Wentworth (Lancet, Oct. 1, '98).

In all cases of leptomeningitis the early occurrence of stupor, coma, or severe convulsions are bad omens; and high fever during the first weeks is always an unfavorable sign. In many cases of acute leptomeningitis, especially when the disease occurs in infants or young children, remissions in the severe symptoms are common from about the fourth to the tenth day, but too often the improvement is but temporary. When this marked remission occurs, it is probably due to the fact that in children the primary shock to the brain is greater than in adults, and, as the brain becomes accustomed to the increased pressure due to congestion and exudate, its functions are reasserted for the interval of the remission, only to be overcome again as the disease progresses and the effusion increases. Recovery from acute leptomeningitis is only rarely perfect, for usually some permanent defect remains as a sequel. These sequelæ may be mental, sensory, or motor in character, depending upon the location, severity, and extent of the inflammation.

Treatment. — The treatment of acute leptomeningitis will depend greatly upon its cause, but aside from those cases originating in diathetic states of the body (such as the rheumatic, gouty, or syphilitic), or those of traumatic or septic origin in which surgical measures may be advisable, the generally-accepted treatment of all cases is mainly symptom-

atic. The cases due to the general diatheses above referred to should, of course, receive appropriate treatment to counteract them, in addition to the other measures necessary to combat the inflammation.

Case of chronic tubercular basilar meningitis in an adult in which the diagnosis was established and cure effected by means of injections of tuberculin. Dennison (Jour. Amer. Med. Assoc., June 3, '93).

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Instance of use of tuberculin in a case of tuberculous meningitis. The injection of a very minute dose after complete coma had persisted for twenty hours was followed by spontaneous movements, ability to speak, and recovery of consciousness. On the next day the paralytic phenomena, the deviation of tongue and face, the pupillary inequality, and ptosis disappeared. The continence of the sphincters was regained to the extent that an enema was retained for an hour and then expelled with fæces, and that there were three voluntary urinations. On the following day the patient seemed to be cured; but later in the same day fever reappeared, with pain and swelling in the left buttock, and the patient died upon the following morning. M. E. Mourange (Gaz. Hebdom. de Méd. et de Chir., No. '89, '96).

Persons afflicted with epidemic cerebro-spinal meningitis should, whenever possible, be isolated, and all evacuations should be rendered sterile by the use of antisepsis. William J. Class (Medical News, Dec. 3, '98).

All varieties of acute leptomeningitis demand a quiet, well ventilated and darkened room, and an intelligent, capable nurse. The patient should be put into conditions of the most perfect mental and physical rest obtainable in the case. All noise, bright light, and unnecessary conversation should be excluded. The food should be nourishing, easily digestible, and given at regular intervals, for special attention must be paid to the stomach in all of these cases, since vomiting is so frequently a decided symptom of the disease. The chief indications during the first week are to relieve pain and procure rest and sleep; to lessen the amount of blood within the skull; and, in some cases, to reduce the general bodily temperature.

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In epidemic cerebro-spinal meningitis there is no known remedy which either checks the disease or shortens its course. Some relief from nervous symptoms is obtained by the use of sedatives and analgesics. Complications must be treated as they arise. The emaciation, weakness, and anæmia demand appropriate hygienic, dietetic, and tonic treatment. Value of lumbar puncture is purely diagnostic. A. H. Wentworth (Lancet, Oct. 1, '98).

Two cases apparently of cerebro-spinal meningitis, one in a boy with high fever, frontal and occipital headache, and retraction of the head; and the other in a man who became comatose in the first day of observation. Both were given large doses of ergot, and recovered. A third patient with herpes and beginning strabismus died under the same treatment. E. G. Cutler (Boston Med. and Surg. Jour., Nov. 24, '98).

For the relief of pain morphine, hypodermically, is, perhaps, the best means. It should be given in doses large enough to produce the required effect. Chloral and the bromides are valuable adjuvants, and they also do good in allaying motor spasm, and the excessive irritability of the nerve-centres. In very young children and in the aged, chloral should be used with some caution, owing to its action upon the heart. The cephalic and spinal ice-bags are also valuable in relieving pain, and at the same time limit the fever. When the patient's hair is abundant the scalp should be shaved.

When the asthenic stage is reached, they should be used with caution, for they may depress very young children to the point of collapse.

For the purpose of lessening the intracranial congestion and limiting the inflammation as far as possible, bleeding has been practiced, but is only proper in young, strong, and otherwise healthy adults. It should never be employed in children or the aged. Dry cupping is valuable and does not exhaust the vitality of the patient. They may be applied to the back of the neck, temples, or behind the ears, and even in cases where general blood-letting is not contra-indicated they are extremely useful in relieving pain and allaying restlessness. Leeches are employed at times.

In chronic hæmorrhagic leptomeningitis, blisters and galvanism to the head (1 to 5 milliampères) recommended. Lombroso (Centralb. für Nerv. Psychi. u. gericht. Psychop., Apr., '92).

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Treatment of case of tubercular meningitis which recovered consisted in ice-bags to the shaved head, poultices over the whole body up to the neck, leeches to the septum of the nose, and potassium iodide, internally, in doses of at first 2 drachms daily. The drug was borne without serious effects. Janssen (Deut. med. Woch., No. 11, p. 169, '96).

When insomnia is persistent sulphonal or trional may be used; or a combination of morphine, chloral, and bromide of potassium, which also helps to control muscular spasms. Hydrobromate of hyoscine is recommended by J. M. Da Costa for the control of muscular spasm. For the severe muscular pains of the epidemic cerebro-spinal disease Roland G. Curtin advises phenacetin as the safest and most efficient of the antipyretics. Weakness is a contra-indication to its use. Mustard plasters or liniments may also be employed for the same purpose.

Result of hot baths in cerebro-spinal meningitis. Case of man, of tuberculous aspect, who suffered from severe cerebro-spinal meningitis. Hot bath was given and was followed by a slight amelioration of the general condition, improvement becoming more marked after each successive bath, until, by the time the eighth had been given, recovery was about complete. In a second case condition of patient was even more serious, owing to cardiac asthenia, and the result was equally satisfactory. Baths were given daily at a temperature of 104° F. and ten minutes' duration. Vorochilsky (Russkaia Med., No. 4, '95).

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In cerebro-spinal meningitis value of hot packs emphasized. The hot cloths are applied for three-fourths to one hour. The rigidity of the neck and hyperæsthesia particularly diminish under this treatment. Schlesinger (Münch. med. Woch., Oct. 27, '96).

Five cases of cerebro-spinal meningitis successfully treated by hot baths. The temperature of the daily bath varied from 99.5° to 104° F. M. Jewnin (Ther. Monats., H. 11, S. 581, '96).

Seven cases of cerebro-spinal meningitis treated by hot baths, of which 5 completely recovered.

Of the deaths, one was a *foudroyant* case, which died within forty-eight hours; the others were in the late stage of the disease, the baths being employed only during the first two weeks.

The method is as follows: The patient is placed in the bath at the temperature of 90.5° to 92.75° F., and hot water gradually added until 104° F. is reached. While in the bath an ice-bag or a Leiter cold-water coil is placed upon the head.

If there is great tenderness of the back, the sheet may be used to move the patient. The bath must be previously cushioned and thorough after-drying omitted. The patient is placed upon a dry sheet, laid upon a woolen quilt, and covered by the same, over which a light cover is placed; he remains in this posi-

tion for one hour before removal. The time of the bath is immaterial—early morning or late evening. Nourishing food, even meat, should be given; even diarrhœa, should this occur, does not contra-indicate it. Wine, brandy (in milk), and also beer, are given. Alfred Wolisch (Ther. Monats., H. 5, '96).

When the pyrexia needs to be controlled, the spinal ice-bag, in addition to the ice-cap, is valuable, and may be supplemented by cool sponging. If more decided measures are needed small doses of antipyrine or acetanilid answer the purpose. Aconite and veratrum viride are used at times in the first days of the disease, for the purpose of quieting the circulation.

Remedies given to directly influence the inflammation are mercury and the iodides. The former may be given preferably in the form of calomel, in small doses frequently administered upon the tongue, as early in the disease as possible. The iodides are of more service during the later stages to cause absorption of the exudate. Both are valuable remedies, and have received the indorsement of the highest authorities. They may be combined with other remedies, for it is desirable to disturb the patient as little as possible.

Those cases arising during the course of acute bowel disorders in infancy demand the removal of the poisonous matter contained in the bowels as an initial step in the treatment, and for this purpose irrigation of the bowels should be employed.

Good results from iodide of potassium and mercury obtained in cerebro-spinal meningitis. Judicious nursing and attention to small and various details is of more real value than drugs. Bristowe (Brain, July, '88).

Case of acute simple meningitis cured. He was treated freely with mercury under the direction of Broadbent. J. J. Clark (Brit. Med. Jour., June 8, '89).

Experiments on dogs showing that by subdural injections of 1 in 4000 sublimate solution tuberculous meningitis may not only be alleviated, but cured. Mannotti (Il Policlinico, Aug. 1, '95).

Literature of '96-'97-'98.

Good results from mercury in nine cases of cerebro-spinal meningitis occurring in an epidemic of grip. Only one case proved fatal. Dose varied from $^1/_{12}$ to $^1/_7$ grain of the bichloride, according to the age of the patient, administered hypodermically once in twenty-four hours in the beginning and later once in forty-eight hours. Consalvi (La Sem. Méd., Jan. 15, '96).

Uniform success with mercury in cerebro-spinal meningitis; $^1/_4$ grain of mercuric chloride is given hypodermically at first and then $^1/_{15}$ grain every hour until there are symptoms of gastro-intestinal irritation. Smith (Jour. Amer. Med. Assoc., June 13, '96).

Method of Dazio in treating meningitis with hypodermic and intravenous injections of mercuric chloride successfully employed. Dinami (La Pediatria, Nov., '97).

The surgical treatment is limited to those cases of simple purulent leptomeningitis in which the disease is localized and accessible to the trephine. Among American surgeons Senn and Keen advise trephining in tubercular cases and washing out the exudate with antiseptic solutions. Cases arising from aural and mastoid suppuration may require surgical measures. It should be remembered that the inflammation in such cases is sometimes on the opposite side of the brain, as in a case referred to by Charles K. Mills in his work on nervous diseases. In such cases special study must always be given to any localizing signs present. Lumbar puncture has been practiced by Quincke in cases of serous leptomeningitis, both for diagnostic purposes and the relief of intracranial tension.

Four cases of tubercular meningitis operated upon by paracentesis of the

theca vertebratis, with the object of relieving pressure from accumulated fluids. There was temporary amelioration of symptoms, although all the cases ended fatally. E. Wynter (Lancet, May 2, '91).

Death in tubercular meningitis caused not by the development of tubercles, but by intracranial compression, by cerebral asphyxia. Rational treatment, therefore, is trephining and drainage. Case of recovery. R. Hirschberg (Bull. gén. de Thér., Nov. 15, '94).

Space between laminæ of lumbar vertebræ best in children, but in adults space between last vertebra and sacrum best. Chipault (Revue Neurol., p. 11, '95).

Case of tubercular meningitis in which puncture caused aggravation. Lenhartz (Lancet, Oct. 19, Nov. 9, '95).

Three cases of tubercular meningitis unsuccessfully treated by subdural drainage. R. H. Russell (Intercol. Quarterly Jour. of Med. and Surg., Aug., '95).

Literature of '96-'97-'98.

Puncture—in a case of tuberculous meningitis in a child of 13 months—succeeded in checking the convulsions and bringing about a peaceful termination twenty-four hours later. Lazard (Jour. de Clin. et de Thér. Infant., May 7, '96).

Lumbar puncture employed in 25 cases, including 19 of tuberculous meningitis. In no case as yet has the puncture produced a cure. A fatal result occurred in all 19 cases of tuberculous meningitis. No improvement seen in the optic neuritis. Lumbar puncture can only be of very limited diagnostic value in tuberculous meningitis. The differential diagnosis between it and the meningitis consecutive to ear disease has not always been made easy by spinal puncture. In tuberculous meningitis the fluid drawn off is clear, usually colorless, but it may be very slightly green or yellow. The specific gravity was about 1010, and the amount of albumin 1 to 1.5 *pro mille*. Traces of sugar were present. The amount of fluid drawn off was usually from 20 cubic centimetres to 30 cubic centimetres, and the pressure high, amounting to 160 millimetres to 300 millimetres water. V. Ranke (Münch. med. Woch., Sept. 21, '97).

Case of tubercular meningitis followed by recovery after lumbar puncture. The diagnosis of tubercular meningitis was made, lumbar puncture was performed, and about ten cubic centimetres of clear fluid were slowly withdrawn. Tubercle bacilli were found, thus establishing the diagnosis. N. L. Stowell (Pediatrics, vol. iv, p. 415, '97).

Lumbar puncture is without great therapeutic value. Even in so-called serous meningitis only one of the four cases upon which it was practiced showed any good results from the operation.

Puncture was done 15 times in 12 cases of tubercular meningitis, and the bacilli were found 9 times in 8 patients; while of 5 punctures in 2 cases of epidemic cerebro-spinal meningitis only 1 yielded the Weichselbaum coccus.

In 4 cases of purulent meningitis pus-corpuscles and streptococci were found in the fluid of 2, streptococci without pus in 1, and many white blood-corpuscles without micro-organisms in the fourth.

Even when lumbar puncture is an undoubted diagnostic aid, the information thus obtained, considering the present *status* of therapeutics, is not of great practical value. Fleischmann (Deut. Zeits. f. Nerv., July, '97).

Case of chronic infantile meningitis with nasal drainage. About 2½ ounces of clear fluid escaped and the child appeared somewhat better. But on the twelfth day after operation the child became weaker and death followed on the twenty-third day. Walker Overend and W. Foster Cross (Lancet, Oct. 29, '98).

Chronic Leptomeningitis (Cerebral).

Definition. — Chronic cerebral leptomeningitis is a chronic inflammatory affection of the pia arachnoid, associated with a great variety of clinical symptoms, according to the location, extent, and grade of the inflammation. The dura and brain-substance are very frequently coincidently affected.

Varieties.—This disease occurs in the large majority of cases in patients past middle life, but an infantile form is described by Gee and Barlow and others in

which the posterior fossa is usually the seat of the inflammation. In location the disease may affect any portion of the membranes, but its most frequent site is the vertex. The exudate found in such cases may consist of serum, pus, lymph, or dense connective tissue.

The chief clinical varieties are: 1. A very numerous class of the chronic insane. 2. Cases following chronic alcoholism, syphilis, tuberculosis, and gout. 3. Infantile cases arising from acute leptomeningitis, inherited syphilis, or tuberculosis. The chief causes of all cases are syphilis, tuberculosis, chronic alcoholism, traumatism, sun-stroke, and previous attacks of congestion or inflammation of the arachnopia.

Symptoms.—The symptoms of chronic leptomeningitis will vary almost indefinitely, as already remarked, with its location, extent, and severity, and the general condition of the patient affected. The symptoms noted in infantile cases have been stupor of some grade, occasional vomiting, headache; rapid, irregular, or slow pulse; diplopia, strabismus, ptosis, irregularity of the pupils, and slight fever. In some cases active vomiting, decided fever, cervical opisthotonos, and spastic limbs, with occasional convulsions, have been recorded. There may be hemiplegia or bilateral paresis or paralysis. The face is sometimes involved alone. All the signs are developed with great irregularity, and the disease runs a very irregular course throughout.

Chronic leptomeningitis is far more frequently seen in male adults, and in old age, and especially among the insane it is a very frequent post-mortem finding. The symptoms observed during life may be any form of chronic mental disease, but it is particularly common in general paresis, chronic mania, and in terminal dementia following all forms of insanity. The exact relationship of the lesions of chronic leptomeningitis found so often in insane subjects is still a matter of some doubt, regarding their importance as causes of the mental disorder. Certain forms of chronic leptomeningitis are undoubtedly merely an evidence of the wide-spread degeneracy of the vascular system, and of the very low general vitality of all the tissues of the body.

In some cases following traumatism this lesion is probably the physical cause of the symptoms observed during life. The blow upon the head which causes chronic inflammation of the membranes is more frequently not attended by fracture, but, from the history given, has been sufficiently violent to cause unconsciousness. Months or even years may elapse before definite cerebral symptoms occur. When they develop they may simulate almost any form of insanity, but, during the course of the disease, the mental symptoms are apt to be variable and irregular, when compared with typical cases of the kind simulated by the traumatic affection. Some form of paresis or paralysis may occur early or late, but is not constant. Pain in the head is the most constant feature, and if this occurs for weeks associated with mental depression or exaltation and a history of traumatism of the vertex of the skull, chronic leptomeningitis may be suspected at the point of injury.

The traumatic cases are, however, very few in number compared with the great frequency of the lesions of chronic leptomeningitis in hospitals for the insane. The importance, however, of the recognition of the traumatic cases has led me to mention it prominently, and to lay stress upon its occasional occurrence without definite localizing symptoms; because very frequently the prefrontal

or the post-parietal region is the site of the injury, thus giving us few motor symptoms, unless the process extends beyond the limits of the original traumatism.

The clinical history of cases of chronic leptomeningitis may present signs of either basal or vertical origin, or focal symptoms may be present, especially in the syphilitic cases. The symptoms do not depend upon the character of the cause producing the trouble, but simply upon the local lesion and its location, intensity, and extent. There is no definite clinical picture to present, and the symptoms noted are those common to several other conditions. It is only when considered in connection with the history of the case and with their mode of development and course that they can point with any certainty to this disease. The symptoms in adults or old age include persistent headache, usually dull and aching, but at times complained of as sudden shooting pains through the head, and in other cases it may be localized dull and boring; rapidly increasing debility, with loss of flesh in the old, with or without paresis of the limbs; profound mental depression, or stupor, or mere apathy or varying degrees of mental exaltation in younger subjects especially; attacks of vertigo or syncope; occasional attacks of causeless nausea and vomiting; optic neuritis may be present, but is often absent; more decided symptoms may exist when the cortex itself is involved, as in a case reported by Mills, presenting "athetoid spasm, myotomia, and diffuse bilateral disturbances of sensation, which was found to be due to chronic convexity, meningitis of both hemispheres with cortical and subcortical softening, the lesion being most marked in the postero-parietal region." This case also had recurring attacks of Jacksonian epilepsy. It is impossible within the limits of this paper to give more than the merest glimpse of the wide range of symptoms which occur in these cases of chronic leptomeningitis. Fully one-half of the cases are secondary to other affections of the brain or to the bodily manifestations of one or other of the diatheses already referred to as etiological factors. Thus, its symptoms may complicate those of brain-tumor or brain-abscess, traumatism, embolism and thrombosis, and cerebral atrophy; or they may arise in the course of general tuberculosis, or as the tertiary stage of syphilis.

Etiology.—Chronic cerebral leptomeningitis arises (1) in infancy or childhood from inherited disease or an acute attack drifting into a chronic conditon, well described by Gee and Barlow. (2) Certain other cases may arise acutely, including the traumatic type of the disease, which can quite frequently be traced directly to a definite injury at the position of the lesions found post-mortem. (3) The largest number of all cases in adults are due to structural alterations dependent upon antecedent syphilis, tuberculosis, chronic alcoholism, rheumatism, and gout, and a large proportion of the cases become insane at some stage of the disorder.

The view is now quite commonly held that infection occurs in these cases as the causative factor. This is, however, by no means proved, and is largely conjectural.

Pathology.—The post-mortem appearances vary a great deal according to the duration of the disease and the nature of the inflammation.

Tuberculosis chiefly affects the base, although its lesions may appear anywhere else over the surface of the hemispheres. The syphilitic lesions appear as more or

less cheesy, gummatous, or fibroid lesions which at times invade the cortex. When the inflammation is of a simple character most of the lesions are of connective-tissue deposits in the pia and especially noticeable in their effect upon the blood-vessels, which may be greatly thickened and even obliterated in areas.

When the cases are of less duration the exudate may be pus or sero-purulent matter mixed with poorly-organized patches of lymph. Cases are numerous in which the cerebral membranes are closely matted together by connective-tissue adhesions, and in such cases the dura may be firmly adherent to the skull and the pia less firmly to the brain-substance. The choroid plexuses and the ependyma frequently show marked lesions, and at times are covered by a lymphatic or purulent exudate. The veins are commonly overdistended with blood, but in long-standing cases, in which there is almost always a marked atrophy of the brain, a compensating œdema of the membranes is usually present, and this serous exudate may be so abundant as to exert sufficient pressure upon the blood-vessels to empty them and cause a post-mortem appearance of extreme cerebral anæmia. In marked cases of this kind the pia-arachnoid may, in its œdematous condition, be fully one-half inch thick over the superior surface of the brain and much thicker when it dips down into the cerebral fissures and sulci. In other cases no œdema is present, but scattered patches of white fibroid thickening are scattered over the surface of the pia, or along the cranial nerve-roots at the base. The location of these often explain special points in the symptomatology during life. Bevan Lewis states that thickening of the pia mater is present in nearly one-half of the autopsies upon insane persons, and my experience, as pathologist at the Morris Plains Hospital for the Insane, fully corroborates his estimate of the great frequency of this lesion in insanity. It is probable that the chronic inflammatory changes above referred to, when occurring in this class of patients, together with the œdema and cerebral atrophy, are all links in the chain of degenerative changes, which are primarily due to pathological alterations in the walls of the blood-vessels. In the tubercular and syphilitic cases, and in those cases due to chronic alcoholism and traumatism, the same cannot be said, for, although it is true that the lesions themselves are most frequently secondary, they have, in such cases, a much greater causal relation with the symptoms observed during life.

Prognosis. — The prognosis is very grave in all these cases. Early recognition of the condition is important, and may result in the cure of some cases, especially among those of syphilitic origin. Operation in focal lesions due to traumatism may likewise effect a cure, but the outlook in the vast majority of cases is bad, for they rarely come under observation until the lesions in the membranes are advanced, and their secondary injurious effects upon the brain clearly well marked.

Treatment. — The patient in whom chronic leptomeningitis is suspected should be relieved of all care and worry as far as possible. The hygiene and diet should be strictly regulated. The exercise should be suited to the physical condition of the patient, and the general vitality increased in every possible manner. Tonics, good food, massage, electricity, and the careful regulation of the bodily secretions are the chief means at our disposal. The man who has been overworked should have complete change of air and scene, and for the otherwise-

healthy cases a long trip to the woods of northern Maine or Canada during the summer and early fall sometimes proves of great value in so changing the nutrition of the patient, and increasing the vital resistive element of the system to such a degree, that a markedly favorable impression is made upon the chronic meningeal inflammation, which is, as we have seen, too often of the nature of a degeneration, in that it usually occurs coincidentally with other degenerative changes.

The other indications are to relieve headache when present, and diminish, if possible, the local lesions. In syphilitic cases treated early there is hope of real or relative cure, or of great improvement in other cases if the general health will permit of mercury and the iodides. In cases permitting their free use, they should be given in full doses to their decided physiological limit. In weak cases small doses must be given, and even these are sometimes poorly borne.

Traumatic cases demand careful study to decide whether an operation should be done. This should only be performed when from the localizing symptoms there is sufficient hope of relieving irritation or pressure symptoms to warrant the risk of trephining. When clearly focal meningeal symptoms occur after traumatism and at the point of injury, the trephine should be used, and if thickened and indurated membrane is found the fibroid tissue should be excised. At times the mere removal of a button of bone will relieve the symptoms, probably by relief of intracranial tension.

Counter-irritation is advised, by some writers, by cautery or seton to the back of the neck. Frequent hot baths may be tried in suitable cases. Ergot and bromides are said to be useful, and do aid in relieving pain. For insomnia it is best to avoid opium, and employ sulphonal, trional, or a mixture of chloral and bromide of sodium. While, in general, advanced cases yield small returns to treatment, some cases of chronic leptomeningitis will be found in which persistent careful treatment will amply repay the effort by the most gratifying results.

Spinal Meningitis.

Spinal meningitis means inflammation of the meninges of the spinal cord. The same general anatomical and pathological conditions govern inflammation of the membranes of the spinal cord as have been referred to in connection with cerebral meningitis. Thus, inflammation of the spinal membranes may be divided into (1) *pachymeningitis*, which may be *external* or *internal* in its location; and (2) *leptomeningitis*, which may be *acute* or *chronic*. Just as in the brain, inflammation of any one of the spinal membranes may spread to and include the others, or the substance of the spinal cord itself may be involved, and this meningomyelitis corresponds in its etiology and pathology to meningoencephalitis occurring so often in the brain as a result of primary inflammation of the membranes. Clinically and pathologically it is impossible to always draw distinctions between inflammatory states of the spinal membranes, and this classification of the subject upon a purely anatomical basis is somewhat misleading, although for purposes of conciseness and clearness of description it has been followed by writers upon the subject.

External Spinal Pachymeningitis.

Definition. — External spinal pachymeningitis means inflammation of the outer layer of the spinal dura mater. It is a secondary affection.

Symptoms. — These will depend upon the location and extent of the pachymeningitis. There is tenderness over the af-

fected portion of the spine, pain radiating over the spinal nerves involved, hyperæsthesia and spasm of the skin and muscles supplied by them, changing to complete anæsthesia and paralysis should the inflammation be a destructive one, or if the nerves are functionally cut off by pressure of the exudate. In extreme cases the spinal cord in compressed, and we may have spastic paraplegia, and other evidences of pressure. A secondary myelitis is often set up by the same cause producing the pachymeningitis, and the symptoms of the lesions are often associated.

Diagnosis. — This depends upon the recognition of the cause. In obscure cases it may be taken for myelitis, with which it is frequently associated as compressive myelitis. A review of the history of pain, hyperæsthesia extending over some weeks or months, with final development of paralytic symptoms, separates the affection from myelitis, with its girdle sensation, decided onset, and early paralysis.

Etiology.—The chief causes of spinal pachymeningitis is caries of the spinal vertebræ, as in vertebral tuberculosis, Pott's disease, and from tumors or abscesses pressing on the spinal column and causing erosion of the vertebræ. It may also arise from collections of pus in the pleura, peritoneum, and posterior mediastinum.

> Case of spinal caries with pachymeningitis involving the dorsal and cauda-equinal regions. Cheesy nodules were found in both lungs and thickened patches of dura, on which were cheesy nodules that pressed upon the cord. The arms and legs had been paralyzed, contracted, and atrophied. Sinkler (Jour. of Nerv. and Mental Dis., June, '90).

> Case of cerebro-spinal meningitis of tubercular origin, beginning in the internal surface of the dura mater of the cord and only involving the bone secondarily. Bewley (Brit. Med. Jour., June 11, '92).

Pathology. — The affected portion of the spinal dura in cases of simple transmitted irritation, may be thickened by organized, newly-formed connective tissue. Very frequently in tubercular cases it is the seat of suppuration or exhibits great thickening with deposits of cheesy pus here and there. When malignant tumor is the cause, it may be indistinguishable from the tumor-tissue.

Prognosis.—The prognosis is bad unless surgical relief can be afforded. Cases caused by Pott's disease offer the most hope of recovery.

Treatment. — This will depend upon the causes mentioned under ETIOLOGY, and the reader is referred to the sections devoted to them for a full description of appropriate therapeutic and surgical treatment. The majority of cases arise from spinal caries: so that the treatment of this affection is practically that of Pott's disease. Counter-irritation may be used from time to time, but only after the spine has been immobilized. Tonics, and a life in the air and sunshine daily, are valuable aids in treatment.

Internal Spinal Pachymeningitis.

Definition. — Internal spinal pachymeningitis is a chronic inflammation of the inner surface of the spinal dura mater, marked frequently by coincident hæmorrhage, and analogous to the cerebral form of the disease.

Symptoms.—The disease begins slowly and no very marked symptoms denote the beginning of the disease. Hyperæsthesia and pain over the spine, or at the periphery of the spinal nerves arising from the diseased area, may be for a long time the only clinical features noted. As the disease progresses there is a gradually-developed paresis, with atrophy of the muscles supplied by these

nerves, together with a corresponding distribution of anæsthesia. When the cord is compressed by the exudate, spastic paraplegia is added to the symptoms, or, if the compression is in the cervical region, all the muscles below that point are spastic and paretic. The reflexes are increased in the paralyzed limbs. Most of the cases die from intercurrent disease or gradual exhaustion, frequently added to by the occurrence of bed-sores.

Diagnosis.—The diagnosis from myelitis may be difficult. In the later stages they are very often associated. Symptoms of spinal-cord irritation are more prominent in the meningeal affection, while anæsthesia and paralysis are usually more complete in myelitis. In internal spinal pachymeningitis the onset is slower, and the developments of the more severe symptoms of the affection is much more delayed than in ordinary cases of myelitis. The history of the case is important in diagnosis, and the coincident existence of cerebral symptoms may assist in forming an opinion. The pain of pachymeningitis is made worse by even slight movements, while that of myelitis is not influenced by movements of the body. Rigidity and contractions of muscles are far more common in internal pachymeningitis, while incontinence of the bladder and rectum is a marked feature of myelitis.

Etiology.—This lesion is found in general paresis of the insane, and also occurs as a result of syphilis, traumatism, exposure to cold, chronic alcoholism, and possibly as the result of the rheumatic or gouty diathesis. Like the analogous brain condition, it is a disease of the male sex in the vast majority of cases, and occurs chiefly after the age of thirty years, most cases occurring between the fortieth and sixtieth years.

Pathology.—The inner surface of the dura presents the same lesions which are seen in the brain in similar conditions of system. There is great thickening of the dura, due to successive layers of pseudomenbranous formation, into which small or large hæmorrhages have occurred from time to time during the progress of the disease. The disease may be found throughout the whole length of the spinal cord, or it may be limited to a few inches or even less. The circumscribed form of the affection is apt to be in the cervical region.

> In hypertrophic pachymeningitis and chronic infarction of the spinal cord, the pachymeningitic deposit extends along the small vessels into the substance of the cord, the small vessels of the periphery being the carriers of the infarction to the peripheral layers of the cord, which are thereby destroyed; while by means of the arteries of the anterior longitudinal fissure the destructive sclerosis invades the cells of the anterior horns and brings about degeneration of the pyramidal tracts, commissural fibres, and the fibres of the anterior root-zones, extending even into the anterior roots; the latter, however, and the spinal-nerve roots in general, are chiefly, and directly, affected by the external pachymeningitic deposit. The foci of softening are the result of infectious cellular infiltration, as was the pachymeningitic process which preceded it. Tuberculosis and syphilis, chiefly the latter, are probably in most cases the diseases from which the pachymeningitis develops. Adamkiewicz (Wiener med. Presse, Apr. 27, '90).

Prognosis. — The prognosis is bad in almost all cases, and chiefly because of the usually broken-down general condition of the patient. A few cases of cure have been reported, and in other cases the symptoms may possibly be arrested by careful and persistent treatment.

Treatment.—The same general measures advised in cases of chronic cerebral leptomeningitis are of use here, and the

reader is referred to the paragraph devoted to its treatment. The earlier the condition is suspected, the greater the hope of relief or cure. Locally, counter-irritation may be tried by means of painting the spine with strong tincture of iodine from time to time, or by means of the Paquelin cautery applied over the seat of the suspected lesion. They act favorably upon the pain and tenderness present. Internally, if the patient's condition will bear it, specific treatment should be cautiously employed in syphilitic cases, the doses being gradually increased. In cases presenting signs of a localized lesion, the question of surgical operation may be considered, which is warranted by the otherwise-hopeless condition which results after compression of the cord is established.

Acute Spinal Leptomeningitis.

Definition.—Acute spinal leptomeningitis means an acute inflammation of the pia-arachnoid of the spinal cord; but very often the spinal dura mater and the spinal cord itself are also affected by contiguity. The view is now general that the disease is almost always due to infection, as is the case in cerebral leptomeningitis.

Varieties.—The chief clinical varieties are (1) cases arising from the infection of epidemic cerebro-spinal meningitis, which may expend itself in some cases on the spinal membranes alone, with very slight or no involvement of the cerebral meninges: (2) sporadic cases of the same disease; (3) cases apparently due to diathetic conditions, including tuberculosis, syphilis, and rheumatism; (4) cases arising in the course of septicæmia, pyæmia, and other acute infectious diseases; (5) cases due to direct extension of the inflammation from the cerebral membranes, usually limited to the cervical cord; (6) cases following traumatism and surgical operations upon the spinal column.

Symptoms.—Acute spinal leptomeningitis has a sudden onset, except in the syphilitic and tuberculous cases, which may arise less abruptly and run a subacute course. The prodromes are usually few and may be so slight as to escape notice. Sometimes there is a general sense of being unwell; or malaise, with restlessness, may be complained of; occasionally there is a history of vomiting for some days prior to the onset. When the onset occurs it is ushered in by a severe chill, sharp agonizing pain in the back, shooting pains in the limbs or about the body, with fever, vomiting, tenderness along the spine, easily elicited by percussion, or made evident by holding a hot, moist sponge over the spine. These symptoms are followed within a few hours by spasmodic rigidity of the spinal muscles, retraction of the head if the cervical cord is involved, and flexion of the limbs upon the trunk, with very marked rigidity of the limbs. The abdominal muscles are contracted, giving an apparent retraction of the abdomen, and the chest-muscles may be so fixed by spasm as to cause embarrassment of the respiration. If the medulla oblongata is affected, rapid, irregular, or Cheyne-Stokes respiration may be observed, with rapid and irregular cardiac action due to the same cause. There is marked general muscular hyperæsthesia, and any attempted movement of the limbs adds greatly to the sufferings of the patient. The pulse may be very rapid, and is often most irregular. The temperature varies from subnormal to 104° F., and a lower range is the rule. The reflexes are diminished except at the beginning, when they may appear to be exaggerated. The skin may be flushed, pale, or livid in appearance. A deep-red, persistent mark-

ing follows the pressure or stroke of the finger-nail over the skin. The form of paralysis which may develop after the symptoms above noted will depend upon the location of the inflammation and the affected roots of the spinal nerves. Usually the inflammation is wide-spread and nearly all parts of the spinal membranes are involved in the process. The most common type of paralysis is spastic paraplegia, with paresis of rectum and bladder. This form in cases surviving this period presents almost identically all the symptoms of cross-myelitis, and as the case progresses bed-sores are a distressing feature of the case. The duration of the disease is from a few days to a few weeks, when, if the patient survive, a slow, tedious recovery may occur. Recovery is nearly always coupled with some degree of paresis or paralysis, which is very persistent, and too often permanent.

Diagnosis. — The diagnosis of acute spinal leptomeningitis is sometimes very difficult. The symptoms of spinal irritation observed in the acute infectious diseases at times simulate very closely this affection, but post-mortem examination does not often reveal its lesions. The course of the disease in these pseudo-cases will generally differentiate them, for it is at the beginning of such spinal symptoms that the mistake is liable to be made. The diagnosis of the different forms met with is often exceedingly difficult. The presence of tuberculosis in the lungs or elsewhere is an aid to diagnosis, and the same may be said of the known presence of syphilitic infection or positive active lesions of this disease. Cases arising during epidemics or endemics are easily recognized. So are the cases arising from traumatism, operations on the spine, and those due to extension from the cerebral membranes. From the nature of the post-mortem appearances it is seen how frequently the spinal cord may suffer in this disease, so that in the later stages myelitis is frequently co-existent with it. In the first of the illness it is distinguished from myelitis by the paralysis and absence of marked pain in myelitis, and also by the very variable character of the pulse and temperature-curve in acute leptomeningitis.

Bacteriological investigation is an important means in the diagnosis of spinal meningitis. This bacteriological observation may be performed by taking a small quantity of blood from a vein, putting it into a thermostat warmed to 98.6° F., and leaving it there for ten or twelve hours. If the diplococcus is present in the blood, numerous colonies of these micro-organisms will be seen upon the surface of the coagulum. Bozzolo (Internat. klin. Rund., Mar. 31, '89).

Literature of '96-'97-'98.

Only 4 cases of central softening of the spinal cord in syphilitic meningitis have been described. It is liable to be mistaken for syringomyelia. Case of female who had had syphilis. The illness began with pain in the back, followed by headache, then weakness and rigidity of legs. The patellar reflex disappeared. Later, painful spasmodic contractions often occurred in right leg, and later still girdle pains became troublesome. The legs finally became atrophied and completely paralyzed, and bed-sores and paralysis of sphincters developed. Post-mortem examination disclosed a central cavity, localized to the gray matter, extending from the lower lumbar to the upper cervical regions, also syphilitic meningitis and syphilitic disease of the vessels. H Wullenweber (Münch. med. Woch., Aug. 9, '98).

From subdural and interspinal hæmorrhage it is differentiated by the great suddenness of the former affections, which instantly produce their symptoms, and always follow some obvious traumatic cause. Subdural hæmorrhage is

usually followed by some grade of leptomeningitis soon after its occurrence.

Etiology.—The great majority of cases arise from infection of the pia-arachnoid, although the source of the infection is often difficult or impossible to trace. The spinal type of leptomeningitis occurs quite frequently during epidemics of the cerebro-spinal form. In general practice the tubercular form is the one most commonly met with. Spinal leptomeningitis is a rare complication of the acute general diseases, such as pneumonia, typhoid fever, scarlet fever, yellow fever, and small-pox. According to Osler, it is very rare in pneumonia, even when cerebral leptomeningitis occurs, excepting for "the first two or three inches of the cervical region" (Osler's "Practice of Medicine"). It is more common in septicæmia and pyæmia. Exposure to cold and dampness is regarded as a cause of spinal leptomeningitis by some writers.

Pathology.—The post-mortem appearances vary with the duration of the case and the nature of the inflammation. The tendency in all cases is to spread, and involve the whole length of the spinal canal, but, in a considerable proportion of cases the inflammatory condition is limited to the cervical region. The spinal membranes and fluid furnish excellent conditions for the growth of pathogenic bacilli, and for this reason wide-spread lesions are usually present.

Cases dying within a few days present intense congestion of the pia-arachnoid, and very frequently of the inner surface of the dura mater, and of the spinal cord itself, with an effusion of more or less turbid serum: or the exudate may consist of sero-plastic lymph. In other cases the exudate is purulent and very abundant. When the disease has a duration of a week or two the autopsy reveals grayish-white opaque pia mater. In cases of longer duration there may be adhesions formed between the arachnopia and the dura, and the pia may be abnormally adherent in places to the spinal cord. Tubercular inflammation here does not differ from that already described in treating of tubercular inflammation of the cerebral membranes, and the syphilitic form of the disease likewise presents the same kind of inflammatory changes which have been described as syphilitic leptomeningitis. All of these acute inflammations finally attack the nerve-roots and the general surface of the spinal cord, and, even in cases which do not show any macroscopic lesions, by the microscope very marked lesions of acute inflammation of the nervous elements are found. The axis-cylinders of the nerves are swelled and degenerated, and in the cord there is proliferation of neurogliar cells, infiltration of leucocytes, granular degeneration of nerve-fibres, and dilatation of the blood-vessels and their sheaths with leucocytes. Various forms of bacteria have been noted, including the pneumococcus of Friedländer and the tubercle bacillus. This condition of meningomyelitis exists in some degree in many of the cases, and at times may be so marked that there is seen macroscopically superficial softening of the spinal cord and the nerve-roots; while, in cases dying after the disease has become chronic, there may be, in addition, extreme changes of the spinal cord and the nerve-roots, from adhesions formed in places between the adherent arachnopia and the dura. In such cases, besides the superficial softening of the cord, there is found parenchymatous alterations of the gray substance or foci of suppuration in other parts of the cord.

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In epidemic cerebro-spinal meningitis two kinds of alternation in the cells of the spinal cord noted. First, slight changes in the cells of the anterior horns, such as occur from various poisons and which is attributed to the toxæmia of the disease, viz.: (1) the disappearance of the stainable substance of Nissl from dendrites or from portions of the dendrite or of a cell-body; (2) the formation of nodular swellings of the dendrites, these swellings corresponding to pathological accumulations of the stainable substance; and (3) a tendency to disorganization of individual Nissl bodies, especially at the periphery of the cell. Second, lesions not all similar to the first, but practically identical with those which take place in the cell-body of a neuron after an injury of the axon which belonged to it. These latter changes were found in the cells of the anterior horns and in those of Clarke's columns. L. F. Barker (Brit. Med. Jour., Dec. 25, '97).

Prognosis. — The prognosis is always grave. It is especially serious at the extremes of life, which bear the disease very badly, and death within a few days is the most frequent termination in such cases. The rapidly-fatal cases are characterized by very abrupt onset, high fever, and extensive involvement of the spine, including the cervical regions. Cases in which the cervical region is affected are always most serious. The outlook in traumatic and syphilitic cases is more favorable, and recovery may in some of these cases be fairly perfect. In the other cases, even when recovery occurs, secondary spinal lesions may result from inflammation and degeneration of areas of the cord itself.

Treatment.—As soon as possible after the onset of the disease the patient should be put to bed, resting on the side, or, as advised by some writers, upon the abdomen, over several pillows placed under the patient. This has the advantage of permitting applications to the spine, but is not always borne by patients. Morphine sufficient to control the agonizing pains should be administered at once hypodermically. Prompt applications along the spinal column should be made, and the means employed may include wet cupping, leeches, thermocautery, repeated dry cupping, and blisters. Leeches should not be used in the cases of young children or in weak persons of any age, but should be reserved for sthenic subjects. Dry cups are a valuable measure when applied vigorously and repeatedly. Care should be exercised not to break the skin, for if myelitis should supervene it would predispose to the formation of bed-sores. If well borne, continuous application of the spinal ice-bag is a valuable measure. At the same time, internally small doses of calomel frequently repeated should be given, with bromides and chloral to diminish spinal irritability. A very valuable remedy, which is often very efficacious in allaying pain, and probably also acts as a powerful detergent, is the hot bath or hot pack.

If there is evidence that the attack is due to syphilis or rheumatism as underlying causes, specific or antirheumatic remedies should be given in full doses at once. Opium, according to Stillé ("Epidemic Cerebro-spinal Meningitis," p. 158, '67), is most efficacious in epidemic cerebro-spinal meningitis, and by analogy it should be used with hope of good results in limiting the inflammation as much as possible. It is needed usually for the excessive pain and restlessness, and may be combined with the bromides and with chloral. Ergot and tincture of belladonna are both used at times during the acute stage to contract the blood-vessels, but the former is more useful, in combination with the iodide of potas-

sium, after the acute stage to assist in promoting absorption, while the value of belladonna in such cases is problematical. In fact, the use of ergot to contract the blood-vessels of an inflamed area is largely a matter of clinical habit, and no definite proof exists that it really has this action upon the inflamed tissues.

Should the patient survive the acute stage, milder measures of counter-irritation are useful in keeping up a detergent effect upon the congested spinal cord. Hot baths may be continued, and the alternate hot and cold spinal douche is of value in relieving the congestion.

Massage and electricity may also be used. Internally potassium iodide is the best absorbent. It should be combined with mercurial treatment in syphilitic cases. Mercurial inunctions may be employed along the spine. They also do good by the counter-irritation caused by them. When cerebral symptoms arise, the treatment is that of cerebro-spinal leptomeningitis, which has already been described.

Chronic Spinal Leptomeningitis.

Definition.—Chronic spinal leptomeningitis means chronic inflammation of the spinal pia-arachnoid. It is frequently associated with chronic inflammatory changes of the adjacent dura and spinal cord, and is usually a sequence of some form of acute spinal leptomeningitis.

Symptoms. — The symptoms in lesser degrees are those of the acute form. Pain in the back, with shooting neuralgic pain in the body and limbs, and frequent paræsthesia of the skin over corresponding areas are the chief symptoms. Paralysis is infrequent except in cases where it may be residual from the primary acute attack. Rigidity and spasm are not marked symptoms of the chronic disease and are more commonly absent. In some cases few symptoms are present during life. In all cases the symptoms are very indefinite. Some form of skin eruption has been noted, with hyperæsthesia, pain, and some rigidity of the spinal muscles. It runs a very chronic course, and usually exists for many years prior to death.

Diagnosis. — The diagnosis is most often obscure, and the condition can only be conjectured from the group of symptoms enumerated, when associated with a clinical history predisposing to the condition.

Etiology.—The chief etiological features are previous attacks of leptomeningitis, chronic alcoholism, syphilis, traumatism, or strain of the spinal column, and as a complication of various forms of myelitis.

Pathology.—The post-mortem appearances which have been noted are thickening of the pia-arachnoid, adhesions of its dura, local thickening of the membranes enveloping the nerve-roots, and adhesions between the pia and the spinal cord, which may be sclerosed at points where adhesive bands are attached to it.

Prognosis.—Recovery from this form is doubtful and probably never occurs, the disease slowly progressing until death.

Treatment.—The treatment is symptomatic. Mild, intermittent counter-irritation may be used with benefit in relieving the pain. Internally the iodide of potassium may be given in doses commensurate with the general condition of the patient and with the existence or not of a syphilitic history. Tonics and all measures tending to improve the systemic condition of the patient are usually necessary to these cases.

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MENOPAUSE, DISORDERS OF.

General Considerations.—All the organic diseases of various kinds begin to show their full effects at about 45 to 50 years. If a woman's organs are not all sound, she is apt to break down at this age; on the other hand, if there are no organic disorders, abnormal conditions do not develop, and the woman who was healthy before remains healthy throughout the climacteric period.

> In women whose nutrition is uniformly approximated to the normal standard, and who reach this period unhampered by pre-existing ailments, the final cessation of menstruation occurs without material disturbance of the functional harmony and is often of cosmetic advantage. The association of morbid conditions with the menopause is accidental and the result, usually, of antecedent causes, especially of unphysiological living. The influence of perfect nutrition and natural living during the premenstrual and adolescent years upon the after-life of women is of the most salutary and far-reaching kind. A. H. Bigg (Amer. Medico-Surg. Bull., Jan., '93).
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> The menopause is a diverted trophic nervo-vascular force, a readjustment of nutritive forces, not life-endangering in itself. J. S. Nowlin (Nashville Jour. of Med. and Surg., Jan., '95).

The various malignant diseases, which are prone to show themselves at about the time of the change of life, are often attributed to menopause as an entity; but, in truth, the vitality with which we are endowed is always diminishing, the reserve force is lessening, and at an age varying from 45 to 55 years there is very little margin to draw upon. This is not confined to women, however, for it is seen in the fact that men are not accepted for enlistment above the age of forty-five, while at sixty they may also be said to undergo a "change of life."

The menopause, properly speaking, is only one feature of the change of life. The woman is no longer strong enough to bear and rear children, except in comparatively few cases. She has not the vitality to endure the continually recurring drain of menstruation, and this function ceases at about the end of the ninth lustrum, varying much according to race and climate.

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> Series of 250 cases studied as regards the age at which menopause takes place. It occurred in 2 women aged 37, in 2 aged 38, 3 at 39, 12 at 40, 3 at 41, 11 at 42, 6 at 43, and 8 at 44. Beyond the normal ages the change came on in 3 patients at 54, and in the same number at 55, and in 1 at 56, and the same number in patients of the age of 57, 58, and 59, respectively. Parviainen ("Mith. aus der gynäk. Klinik der Prof. Engstein," vol. i, Part II, '97).
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> Cases of early menopause may be confounded with transitory superinvolution of the uterus, associated with amenorrhœa and climacteric signs and symptoms. McCann (Univ. Med. Mag., Mar., '98).

The disorders of the menopause, *per se*, are really only those which are in some way connected with the cessation of menstruation, and they are comparatively few and simple; while the disorders and symptoms occurring at the period of the change of life or grand climacteric in either sex, but especially in woman, are many and various, and often very severe.

Of late years the frequency of operations for the removal of the ovaries has caused the subject of the sudden and artificial menopause thus brought about to assume great importance, and, as its symptoms and its disorders can be studied apart from the symptoms of advancing age and progressive disease, much valuable light has been thrown on the question of the menopause proper by studying the history of the symptoms following the post-operative menopause.

Among the afflictions which are customarily attributed to menopause are the most-varied nervous manifestations, and disturbances of temperament, and even of mental condition. But here, also, it is necessary to discriminate between what is due to the cessation of menstruation, and all the woes that begin to darken the life of so many middle-aged women. For, at this period, some women are profoundly unhappy, and not without reason. Beauty fades, they grow obese and gray, and feel their age in all their social relations. Above all there is the feeling that there is no proper sphere of activity left for them. They have no business, as men have, to occupy their attention. A woman very probably has no interests which really engross her and give her an aim in life. It is, indeed, a change of life; but it really has nothing to do with the menopause. The nervous system feels the influence of these altered conditions, and despondency continues until she gets used to her new relations with her surroundings and acquires new interests.

General Symptoms.—The disorders of menopause are divisible into two general classes, which are subdivisible into several subclasses:—

I. Disorders of the circulation	Flashes. Hæmorrhages.
II. Disorders of the nervous system	Palpitations. Hystero-neuroses. Psychical Disturbances.

Besides these, it is necessary to recognize, practically, a third division:—

III. Complications, or disorders incident to the period of life during which the menopause occurs.

Disorders of the Circulation.—*Flushes.*—When flashes, or flushes, occur the blood rushes suddenly to the surface of the body, particularly to the face and neck, causing a violent burning and tingling sensation and a high color, followed in a few minutes by a free and distressing perspiration. These phenomena are best observed in vigorous young women from whom the ovaries have been removed, for in them the flashes often come on within two or three weeks of the operation, and continue for several months, or even for over a year. They may recur as often as once in fifteen minutes, but generally the intervals are somewhat longer. After six or eight weeks the flashes become less frequent, without diminishing much in violence, and finally they diminish both in frequency and intensity, until they cease to recur.

[The following description of her sensations is written by a very intelligent young lady, from whom the tubes and ovaries were removed eighteen months previously, for a small fibroid of the uterus, with retroversion and incarceration. The tumor in the uterus has diminished in size during the interval of time, and the uterus is held in proper position by ventrofixation.

"I am afflicted regularly with 'flashes' at intervals of from 40 to 50 minutes, day and night. They are sometimes preceded by slight faintness or chill; then, again, with dizzy feeling, or slight headache. I can almost feel myself turning pale, when it seems that the blood is leaving every part of body; so noticeable is it that just previous to a 'flash' I have been asked 'Are you cold?' 'Are you faint?' or 'Are you ill?'

"In a few seconds, however, a sort of resigned feeling unconsciously takes possession of me, when suddenly a wave of heat rushes over face, arms, and upper part of body, face and hands turn a most uncomfortable red color; soon the heart beats very hard, and I can almost hear it thumping. Soon beads of moisture begin to stand out on my forehead, chin, neck, at joining of lower and upper arms, and on bosom, after which the heat per-

meates the lower part of body, to my toes.

"When a 'flash' is preceded by drowsiness, for some few seconds I can scarcely keep my eyes open—seem to be as in a dream, and arms and legs feel heavy. When preceded by a chill, hands and feet feel cold. Always before 'flash' my throat feels parched, and I am very thirsty. 'Flashes' seem to be more severe after a hearty meal." E. W. CUSHING.]

In the physiological menopause the same flashes are observed, although, usually, they are much less violent; they are also apt to last rather longer, sometimes for two years or more. Although these are usually classified as disturbances of the circulation, they are properly nervous phenomena. The vascular system merely responds to the stimulus which causes blushing under emotion, and is not in itself disordered at all. The whole subject, therefore, might be included properly under the disorders of the nervous system.

Hæmorrhages. — Perhaps the same might be said about the sudden attacks of hæmorrhage which sometimes occur at about the time of the menopause, just as they do at puberty, and, indeed, occasionally at all periods of the sexual life of woman.

So many cases have been reported that it must be admitted that such hæmorrhages really occur at the menopause, merely as a result of vasomotor disturbances, and without any appreciable disease of the uterus.

Nevertheless, a vigilant and painstaking skepticism should be the rule, for usually some complication will be found which will account for the hæmorrhages, especially if they are repeated and recur at intervals covering a considerable space of time. The apathy and credulity with which the women attribute these hæmorrhages to the change of life are only the result of the false teaching of the profession at times when the pathology of uterine diseases was not understood. Many a valuable life is lost because flow at this time is attributed to the climacteric, when really there is grave organic disease present and progressing.

Not infrequently the climacteric is preceded by two or three periods of excessive flow of blood without any special local pathological change. A. R. Simpson (Clinical Jour., July 18, '94).

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Climacteric hæmorrhages are due to arterial sclerosis. Reinicke (Arch. f. Gynäk., B. 52, H. 2, '97).

DISORDERS OF THE NERVOUS SYSTEM. —"*Palpitations.*" — The symptoms of "palpitation of the heart" and of attacks of syncope from which women suffer at the time of the climacteric are quite similar both in kind and degree to those with which a certain proportion of women of all ages are troubled. The only feature peculiar to the change of life is that women often present these symptoms at that period who have not been troubled in this way during their previous years, and who certainly have no organic lesion of the heart. Like the flushing and the uterine hæmorrhages mentioned above, these symptoms are to be understood as disturbances of regulation, not as diseases.

Tachycardia in women is most often seen during the menopause. Those who pass through the change early are more liable to it than those who menstruate until later in life. It occurs with special frequency when the menopause has been prematurely induced by surgical operation or disease. Baldwin (Brooklyn Med. Jour., Nov., '95).

Hystero-disturbances and Psychical Disturbances.—These phenomena do not differ at all from those which affect nervous and hysterical women at other periods of their lives, the only peculiarity is that they sometimes attack women

who have always been free from such troubles.

It will not, therefore, be necessary to describe the various symptoms and varieties of hysterical and hysterico-neurotic disturbances, the alterations in temper and temperament, ranging all the way from caprice to melancholy, which may affect women at this change of their lives. What is desirable to know is why these disturbances should affect some women at this time and not others, and whether anything can be done to relieve them.

It is quite evident that at the menopause we have to do with two processes: (1) the cessation of function of the ovaries and of the menstruation, which is the accompaniment of such function; (2) the involution of the uterus, which goes on, or should go on, *pari passu* with the diminution of ovarian activity. The histories of women who suffer from hysterical and nervous disorders at the menopause, and those of women who suffer from hyperinvolution or from originally insufficient development of the uterus are very similar, and careful study of individual cases has led me to believe that the disturbances of the former are largely due to want of proper relation in time or in amount between the diminution of functional activity and the involution of the ovaries and of the uterus, respectively.

When the function of the ovaries ceases too suddenly for the uterus, or when — owing to congestion, endometritis, polypi, small fibroids, or other causes—the uterus cannot undergo involution concurrently with the ovary, flashes and hæmorrhages follow, complicated with the general train of symptoms witnessed after surgical removal of the ovaries.

When, on the other hand, the uterus tends to cease its functions sooner than the ovary, stimulation originating from the latter to continue menstruation gives rise to a set of symptoms similar to those witnessed in cases of hyperinvolution of the uterus after childbed or prolonged lactation or exhausting diseases; or in cases of undeveloped uterus, where after puberty the infantile condition of that organ remains, while the ovaries develop fully.

Atresia of the uterus after the menopause occurs pathologically much more frequently than is supposed. The atresia is physiological only after complete atrophy of the body of the uterus and its endometrium. The symptoms of the condition mislead by directing attention to the nervous system more particularly than to the true seat of disease. H. L. E. Johnson (Jour. Amer. Med. Assoc., Dec. 7, '95).

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At the period of the menopause the vulva is apt to become affected with local hyperæsthesia, which is a symptom of many conditions. It may be due to a pure neurosis; to reflex cause, such as early carcinoma cervicis; to mucous polypus or prolapsed ovary; or to kraurosis, local rashes, dirt, parasites, vaginal or uterine discharges; irritating urine, as in cases of acidity, gout, or diabetes. Amand Routh (West London Medico-Chir. Soc.; Univ. Med. Jour., Mar., '97).

Neuroses seen at the time of the menopause show many gradations from nervous irritability with effects on the character and temper to fully-developed insanity, which has a tendency in a large proportion of cases to melancholia, a delusional insanity, less frequently to mental weakness, and rarely to general paralysis. The change in the reproductive organs leads in some to a morbid querulousness, in others to a jealousy. Sexual excitement sometimes is developed which exceeds all control, depraved and vicious habits may show themselves, and dangerous accusations be made. Drunkenness and the drug-habit are especially noted at the climacteric. Charles Luke

(West London Medico-Chir. Soc.; Univ. Med. Jour., Mar., '97).

Attention called to dyspareunia at this period. Cases occur where the introitus is small; the mucous membrane of the vulva has already acquired that smooth and glazed appearance characteristic of senility, and around the ostium vaginæ are certain red, well-defined circumscribed spots, extending forward and involving the meatus urinarius and the urethral canal. These are exquisitely tender and bathed in a muco-purulent discharge. Mansell-Moullin (West London Medico-Chir. Soc.; Univ. Med. Jour., Mar., '97).

While the cilia of the uterine and cervical epithelium grow scanty in sickly women near the menopause, they sometimes remain perfect in women over 60 where the uterine muscular tissue has undergone degenerative changes perceptible to the naked eye. Parviainen ("Mith. aus der gynäk. Klinik der Prof. Engstein," vol. i, Part II, '97).

Headache, nervousness, hysterical manifestations of all kinds, depression of spirits, change of temperament always for the worse, even real melancholy and insanity; such are the woes which are added to the unpleasant conditions inseparable from this age, and referred to in the beginning of this article.

Attention called to the very intimate relation which exists between the menopause and the pathological conditions of the uterus and exophthalmic goitre. In this relationship the latter is placed in the position of an effect or consequence, and not the cause, of the uterine condition. An improvement in the local condition is always followed by the appearance of the general disease. Jouin (Nouv. Arch. d'Obstét. et de Gynéc., No. 6, '95).

Sensory throat-neuroses are common at the menopause. The sensations of which these patients complain vary enormously in kind and in intensity, but can all be summarized under the two large headings of paræsthesia and of neuralgia, the former being by far the more frequent one. In the very worst cases, which are rare, the suffering appears to be extreme and the mental condition of the patient deplorable. In a large number of cases the throat-symptoms complained of are the only sign of the approaching change of life, and sometimes even precede the menstrual irregularities. In another perhaps equally large number they either follow the usual uterine disturbances of the climacteric period or are associated with other complications of the menopause. In a very large number the appearances are quite normal; in other cases, when in women during the climacteric period, a few small pharyngeal granulations or a very slight enlargement of the lingual tonsil or some hardly noticeable thickening of the lateral folds of the pharynx are detected. Felix Semon (Brit. Med. Jour., Jan. 5, '95).

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Investigation of one hundred cases of insanity occurring during menopause. The forms were present as follows: Melancholia in 67 per cent.; mania, 24 per cent.; dementia, 4 per cent.; epileptic insanity, 3 per cent.; general paralysis, 2 per cent. The prognosis is usually favorable, 40 per cent. recovering. The duration of the attack varies from three months to three years, after which time the outlook is hopeless. Henry Sutherland (Univ. Med. Jour., Mar., '97).

Complications.—The complications or diseases incident to the time of life at which the menopause occurs are, in reality, the factors that have caused the change of life to be dreaded and to be looked upon as a serious crisis.

In all cases in which a patient comes under the care of the physician at this age, perhaps more than at others, it is important to ascertain that the heart and kidneys are free from organic disease. This is the period when these organs are apt to fail, in either sex.

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Attention called to the frequency of utero-ovarian irritation at the time of the menopause as a factor in the causa-

tion of rheumatoid arthritis. W. Armstrong (Brit. Gyn. Jour., xliv, 496, '96).

Following the cessation of the menopause the modification of the menstrual flow can cause a congestion of the kidneys, varying in its intensity. The symptoms observed have been oliguria, albuminuria, and hæmaturia, often accompanied with lumbar pains, nausea, and headache. Local bleeding and mild diuretics recommended. Le Gendre (Medico-Surg. Bull., July 25, '98).

Of the diseases more closely connected with the genital system, first in importance, first in gravity, and most serious if neglected, is cancer of the uterus or of the vagina. In all cases of undue or irregular bleeding from the genital tract it is imperative to make a thorough local examination, since in a large proportion of cases the cause will be found to be a cancer. In this matter the knowledge and care of this generation of physicians must undo the mischief that has been wrought by the false teaching of previous generations, that irregular hæmorrhages were natural to the change of life. The truth is that the menopause is an evil period, when cancers are liable to develop.

"Ulceration of the uterus" was also—and is still—too often diagnosticated in cases of uterine cancer attended by intractable bleeding and only recognized when the disease is far advanced and the patients have lost their only chance of rescue.

Certain axioms should guide the modern practitioner in this connection:—

1. All irregular or profuse hæmorrhages about the period of the change of life are suspicious; they therefore require immediate, thorough, and competent examination.

Analysis of the complications of menopause in 500 women. Out of this number, the flow of blood returned a year or more, after the menopause had become established, in 183 cases. Of these over one-half, or 54 per cent., were found to be suffering from uterine cancer. Neumann (Monats. f. Geburts. und Gynäk., B. 1, H. 2, '95).

Literature of '96-'97-'98.

Diagnosis between benign and malignant bleeding after menopause. Menorrhagia of the menopause appears as a sudden and very free discharge of blood following distinct cessation of the catamenia for two or three months. The discharge occasionally recurs. The bleeding of cancer is insidious, irregular in character, and very frequently appears in the interval of the period during the last year or two of menstruation. Doléris (Bull. et Mém. de la Soc. Obstet., etc., Paris, No. 7, '97).

2. All cases of incipient cancer of the uterus are easily diagnosticated by careful examination, aided by the curette and microscope in doubtful cases, but usually by the presence and character of an ulcer.

3. All cases of cancer of the uterus in the early stages are susceptible of complete removal by total hysterectomy, with less than 2 per cent. of mortality in competent hands. There is, in fact, no organ of the body where cancer can be so totally and widely removed as in cancer of the uterus.

4. A large proportion, probably a large majority, of cases in which total extirpation of the uterus, for cancer, is performed quite early, never have relapse or recurrence in the scar or elsewhere, and they enjoy, not only life, but the best of health.

Next in frequency, after cancer, when hæmorrhage occurs after menopause are intra-uterine or intramural fibroids. There may also be polypoid growths in the uterine cavity of the ordinary mucous and glandular type. All these may give rise to frequent hæmorrhages that tend greatly to reduce the strength of the patient.

[I have repeatedly removed such growths from women between 45 and 55 years, who had suffered from profuse flowing for long periods under the impression that it was a natural accompaniment of the change of life, and that nothing could or should be done to relieve it. E. W. CUSHING.]

The tendency to obesity after menopause may cause neoplasms of the genital system to be overlooked. The following are the disorders at all likely to be confused with fat-accumulation after menopause: lipomata, dermoids, fibroids, tumors of abdominal wall, encysted peritonitis, hydatids of peritoneum, "ovarian tumors." Manton (Med. Age, July 25, '95).

Case in which a large unilocular blood-cyst developed in the wall of the uterus after menopause. J. C. Webster (Amer. Jour. Med. Sci., Mar., '95).

Literature of '96-'97-'98.

The menopause has very little, if any, influence in arresting the growth of uterine fibromata in a large number of cases; indeed, many examples of their rapid increased growth have occurred. One of the strongest indications for hysterectomy after the menopause is the tendency of the tumor to undergo some form of degeneration which, of itself, may prove fatal. Hysterectomy after the menopause should be resorted to whenever the usually-accepted symptoms present themselves which are acknowledged to be of sufficient gravity to require that operation in any other period of life. J. T. Johnson (Med. Review, May, '98).

An erroneous idea prevails that the pathological history of fibroids terminates with the establishment of the climacteric. On the contrary, it may only begin at that time. Pieque (La Gynéc., Apr. 15, '98).

Of special importance is the condition of adenoma of the uterus, which attacks women of this age, often after they have ceased to menstruate entirely. Coming on with the symptoms of a simple hypertrophic endometritis, it is, perhaps, treated by curetting, and apparently cured for some months, when the hæmorrhages commence again, and unless hysterectomy is performed the disease gradually, but inevitably, passes into cancer of the body of the uterus. The diagnosis is easily made on the first curettement, by the abundance and the microscopical character of the pieces of tissue which are removed. As soon as the diagnosis is certified hysterectomy should be performed.

Simple endometritis, with more or less thickening of the mucous membrane, is very frequent at the time of the menopause; it tends to delay the cessation of the menses, especially if there is any polypoid formation, as above mentioned.

In some cases the menstruation either ceases or is very scanty, and the menopause thus occurring is accompanied with nervous symptoms, hot flashes, or even severe hystero-neuroses. A local examination is also important, since some uterine trouble will generally be found to account for the symptoms. In some cases the uterus is retroverted, heavy, and sensitive; in others it is apparently normal in size and position, but it is tender on pressure, and if a sound is passed into it the endometrium of the fundus is found to be extremely sensitive and perhaps thickened.

Treatment.—In regard to the nervous symptoms, great caution should be used not to commence a course of treatment with narcotics, which is apt to have disastrous consequences. Morphine, cocaine, and other habits are easily contracted by these cases. If all local disorders are properly diagnosticated and treated, and nervous symptoms still exist, attention should be paid to the general condition. A kindly word and a little consolation will often go farther than medicine in alleviating the nervous manifestations. When the circumstances of

the patient permit it, change of scene, particularly foreign travel, is of the greatest advantage. Anything that will give the woman an interest in life and take her thoughts off herself is distinctly beneficial.

Simple endometritis with more or less thickening is easily cured by curettement and application of strong solution of iodine and carbolic acid, or of peroxide of hydrogen, to the uterine cavity. At the same time any raw surfaces at the angles of the *os uteri*, the result of old laceration, should be carefully repaired, for it is precisely in these neglected lacerations that cancer is so prone to develop.

Curettage of the cavity of the uterus in fibroids where the chief symptoms are menorrhagia and metrorrhagia is useful in three classes of cases, viz.:—

1. In cases suitable for operation; but when the patients are debilitated by loss of blood the procedure affords a period of rest and freedom from hæmorrhage, which allows of recuperation before the major operation.

2. In cases of small fibroids which do not cause pain.

3. In cases in which the menopause is approaching.

In the latter class the operation may have to be repeated several times. Orloff (Med. Chronicle, Aug., '94).

In cases in which there is retroversion or the endometrium of the fundus is found thickened and extremely sensitive, appropriate treatment, by replacement and support, if necessary, and by dilatation of the cervix, and applications of carbolic acid or peroxide of hydrogen to the endometrium, will usually have the happiest results.

The hæmorrhages are sometimes sufficiently severe to demand active treatment, even when no local lesions are to be discerned.

Hæmorrhage is of the first importance in the climacteric. Purgatives should be employed, particularly against the hyperæmic disturbances and collateral congestion which give rise to the complex symptoms of abdominal plethora. No drastic purgative, however, should be used, but only such as exercise a gradual and continued influence upon intestinal activity, such as pulp of prunes, tamarinds, manna, rhubarb, and the moderate salts. Enemas and intestinal irrigation are also of value, with dietetic and hygienic measures, Glauber salts, and potash-salt waters. In severe hæmorrhage rest and cold-water injections are indicated, with the addition of aqua ferridi, sus aqua chloridi (15 to 250). If the flooding does not cease, the vagina should be tamponed with iodoform gauze, and ergot given internally, 20 drops every hour or two. Kisch (Med. Neuigkeiten f. prak. Aerzte, Apr. 8, '93).

In the hæmorrhages of the menopause hydrastinine is preferable to hydrastis. Porak (Bull. de la Soc. de Méd. Prat., Mar. 15, '92).

Cycling may have an injurious effect on women at the time of the menopause, and should not be indulged in except on the advice of a physician, especially if the patient is anæmic and has functional cardiac trouble. H. Macnaughton Jones (Med. Press, Nov. 4, '95).

Literature of '96-'97-'98.

In climacteric hæmorrhages rest, strict regulation of diet, with the avoidance of alcohol, strong tea and coffee, and the use of laxatives are sufficient in mild cases. Dilatation of the cervical canal and intra-uterine applications of Monsell's solution are preferable to curettement. In obstinate cases in which the patient is really in danger from repeated hæmorrhages total extirpation is indicated, the results being quite satisfactory, while the mortality is only a little over 1 per cent. Reinicke (Archiv für Gynäk., B. 52, H. 2, '97).

The treatment of the various symptoms occurring in the course of the menopause does not differ from that of the same phenomena as witnessed in

various diseases. Hence symptomatic treatment meets all indications.

In the treatment of pruritus of the vulva or vagina, so often a complication of the menopause, the patient should be given a lukewarm bath (88° F.) before going to sleep, with the addition of 2 pounds of wheat-bran, placed in a linen sack in the bath. After the bath the vulva and surrounding parts are dusted with the following powder: Salicylic acid, 1 part; starch and talcum, of each, 50 parts; mixed and used as a dusting-powder, several times daily. Of special significance in the climacteric is the diet. Kisch (Med. Neuigkeiten f. prak. Aerzte, Apr. 8, '93).

Ovarian therapy in the treatment of the phenomena of the menopause has been reported with more or less success. It consists in the administration of the ovary in its natural condition, ovarian powder obtained by desiccation, or a glycerin-extract. The remedy may be given in 2-grain doses before meals. It is usually best to begin with one dose before the noon meals. The remedy is credited by various clinicians with the power of arresting the untoward effects during the climacteric or preventing them when the menopause first manifests itself.

Literature of '96-'97-'98.

Ovarian extract given in twelve cases with the best results. The patients suffered from the usual nervous condition, the result of oöphorectomy or normal menopause. No disagreeable effects from the exhibition of the drug in tabloids, and no constitutional disturbance were noted. Improvement in the symptoms began after the lapse of about forty-eight hours, and cure was complete within a month. Mond (Münch. med. Woch., No. 36, '96).

Successful treatment by fresh ovarian tissue of climacteric disturbances following castration. The dose was 77 grains twice a day, gradually increased to 310 grains, the general condition of the patient and the character of the urine being watched carefully. The treatment was continued for eighteen days, before which time any temporary stoppage of the drug was followed by an increase in frequency of the attacks of dizziness, flushing, and palpitation. After the eighteenth day the stoppage did not cause any trouble, and the patient was discharged suffering from only four or five light attacks daily that did not cause her any inconvenience. F. Mainzer (Deut. med. Woch., Mar. 19, '96).

In seven cases in which there were severe symptoms during the natural menopause pastilles made from the dry ovarian substance (cow), each pastille containing 3 grains, were successfully employed. Chrobak (Centralb. f. Gynäk., No. 20, '96).

Ovarian tablets possess the power of modifying the unpleasant phenomena of the climacteric, whether physiological or anticipated, without producing evil effects. Landau (Berliner klin. Woch., No. 25, '96).

By use of ovarian extract disagreeable symptoms of the natural menopause are relieved or disappear. It rapidly overcomes the metrorrhagia of the menopause not connected with new growths. Results of treatment are usually apparent on the second or third day. Preparations in wine preferred, daily dosage being 5 drachms, containing 3 grains of ovarian extract. Jacobs (Dublin Jour. Med. Sci., Sept. 1, '97).

Oöphorin preparations given to women suffering from acne rosacea and cutaneous disorders at the menopause, with satisfactory results. E. Saalfeld (Berliner klin. Woch., No. 13, '98). (See also ANIMAL EXTRACTS, in volume i.)

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MENORRHAGIA. See UTERUS.

MENTHA.—Two varieties of mentha, mentha piperita and mentha viridis are employed in medicine.

Mentha Piperita.

Mentha piperita, or peppermint, is the leaves and tops of *Mentha piperita* (order

Labiatæ): a plant indigenous to Great Britain, but naturalized in the United States and many other countries. It has an aromatic odor and taste, and contains a volatile oil, from which is obtained menthol, the so-called peppermint-camphor. The oil of peppermint is soluble in alcohol, ether, and chloroform.

Preparations and Doses.—Aqua menthæ piperitæ, $^1/_2$ to 2 ounces.

Oleum menthæ piperitæ, 1 to 5 minims.

Spiritus menthæ piperitæ, 10 to 30 minims.

Trochesci menthæ piperitæ ($^1/_6$ minim of oil), 1 to 5 troches.

Therapeutics. — The bruised fresh leaves, or the fresh leaves made into a poultice, are useful domestic remedies for the relief of colic, sick headache, nausea, and painful affections (colic, rheumatism, etc.). Peppermint-water is used as a flavoring to cover the taste of nauseous medicine, and as an antispasmodic to lessen the griping effect of certain remedies. It is a popular remedy for colic and flatulence in infants, especially when combined with a small dose of bicarbonate of soda (soda-mint). The spirit and troches may be used for the same purposes in adults. The oil has analytic properties, and may be painted over the course of the nerves, in neuralgia, and over the painful joints in arthralgia. Evaporation should be prevented by covering with oiled muslin. It is also useful in myalgia and chronic gout.

In toothache a pledget of cotton, wet with the oil and inserted into the cavity, will give relief, acting both as an antiseptic and an analgesic.

The troches are useful to disguise the breath, or as a carminative and stimulating stomachic.

In acute rheumatism the oil may be applied to the painful joints and covered with cotton and oiled muslin.

Inhalations of the oil have been recommended in pulmonary tuberculosis, but clinical experience seems to show that its value is slight.

Mentha Virides.

Mentha virides, or spearmint, is the leaves and tops of *Mentha virides*. It is a widely-distributed variety of mint, possessing properties similar to those of peppermint, but, being less powerful, is often preferred for children. The active principle is a volatile oil.

Preparations and Doses.—Aqua mentha virides, $^1/_2$ to 2 ounces.

Oleum mentha virides, 1 to 5 minims.

Spiritus mentha virides, 15 to 40 minims.

Therapeutics. — The preparations of spearmint are used in the same manner and doses as those of peppermint. Their taste, is, perhaps, less agreeable, but they are often found to be more acceptable to the stomach. Several other species of mint are used in medicine, though non-official. These have properties similar to those of peppermint and spearmint.

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MENTHOL.—Menthol is the stearopten from the essential oil of *Mentha piperita*. It occurs in colorless crystals, having a strong peppermint odor. It is soluble in alcohol, ether, bisulphide of carbon, oils, and acetic acid, and is very slightly soluble in water. It melts at 110° F. It may be fused or compressed into cones or pencils. Chinese and Japanese oils of peppermint are richer in menthol than the official oil. Menthiodol is a mixture of 4 parts of menthol and 1 part of iodol, usually molded into cones or pencils, and used the same as menthol. Menthophenol is obtained

by mixing 1 part of phenol and 3 parts of menthol, and then melting the mixture; it is antiseptic and analgesic.

Physiological Action.—Menthol in the frog paralyzes the spinal centres, then the nerve-trunks; small doses excite, while large doses paralyze, the heart and cause the respiration to become shallow and slow. There is irregular reduction of blood-pressure and loss of sensibility, the animal growing quite cold. Binet recently showed that menthol was not eliminated by the lungs, as was at one time believed to be the case.

The sensation of cold produced by menthol when applied locally was shown by Goldscheider not to be due to actual lowering of the temperature of the surface. In fact, the application of a solution of menthol he found to be followed by a rise of 2° C. He, therefore, attributes the sensation to the influence of the drug upon the peripheral nerves of sensation: an action quite independent, also, of evaporation.

Therapeutics. — Gastro-Intestinal Disorders.—Menthol may be given in doses of 3 to 5 grains in capsules for the relief of nervous dyspepsia and diarrhœa. It has also been used in the dose of 1 or 2 grains as a sedative in gastralgia. It is, however, contra-indicated if there is present any acute inflammation of the stomach.

Menthol has been used in the vomiting of pregnancy. Hourly doses of a teaspoonful of the following are recommended by Hare:—

℞ Menthol, 15 grains.
Whisky, 6 drachms.
Syrup, 1 ounce.—M.

Gottschalk's formula is:—

℞ Menthol, 1 part.
Alcohol, 20 parts.
Distilled water, 150 parts.

Weil's formula:—

℞ Menthol, 1 part.
Olive-oil, 4 parts.

Dose, 10 drops, with powdered sugar.

Squibb's formula:—

℞ Menthol, 40 parts.
Oil of bitter almonds, 180 parts.

Dose, 6 to 10 drops on loaf-sugar.

Case of a woman who had vomited after each meal for three weeks relieved at once by the use of menthol. In order that the drug may remain in solution it may be given in the following form: Menthol, 1; dissolved in spirit vini, 20; syr. sacch., 30. Of this mixture a teaspoonful is given every hour. L. Weiss (Wiener med. Woch., p. 496, '90).

Literature of '96-'97-'98.

The following may be used in case of the vomiting of tuberculosis:—

℞ Menthol, 4 grains.
Syrup, 5 ounces.—M.

Shake well before using and give two or three teaspoonfuls at short intervals after each meal.

This treatment is an excellent one to follow the use of chloroform-water or ice. Editorial (Jour. des Prat., Jan. 9, '97).

Following mixture recommended to control the vomiting of seasickness:—

℞ Menthol, 1.5 grains.
Cocaine hydrochlorate, 3 grains.
Alcohol, 2 ounces.
Simple syrup, 1 ounce.

One teaspoonful is to be given every half-hour until several doses are taken. A. Morel-Lavallée (Le Bull. Méd., vol. x, p. 1199, '98).

Painful Disorders.—For the relief of pain and pruritus, menthol is an efficient remedy applied in the form of a cone or pencil, in alcoholic solution, or in ointment. One drachm of menthol may be dissolved in 4 ounces of soap liniment for external uses. The pain and itching of herpes zoster and urticaria

may be relieved by a 5-per-cent. ointment of menthol.

Menthol given internally with success in migraine and other painful disorders, the dose being 5 to 20 grains, three times a day. It may be administered in capsules, or, better, in a 20-per-cent. alcoholic solution in a wineglass of hot water. Dana (Med. Record, Sept. 29, '88).

Following prescription to be used for the internal administration of menthol in hemicrania, infra-orbital neuralgia, cephalalgia, rheumatism, and in sciatica. The dose varies from 4 to 15 grains:—

℞ Menthol, 2 drachms.
Alcohol, 1 ounce.
Glycerin, 1 ounce.
Syrup, 1 ounce.

M. Sig.: One teaspoonful in warm water when required. McLaury (St. Louis Polyclinic, June, '89).

A 3- or even a 6-per-cent. solution in spirit found more effective in pruritus than boric or salicylic acid. An ointment of it made with lanolin is very useful in pruritus senilis. Saalfeld (Viertel. f. Derm. u. Syph., H. 1, '88).

Oleic acid recommended as a useful solvent of menthol. Two hundred grains of the latter may be dissolved in ½ fluid-ounce of the acid, and the combination forms a valuable remedy in pruritic affections. Remington (Amer. Pract. and News, Mar. 13, '88).

Menthol used with success in all pruriginous affections of the skin, especially when aggravated by scratching, as in urticaria, some varieties of eczema, and scabies. It may be prescribed in a 5-per-cent. alcoholic solution, a 10-per-cent. oily solution, ointments of 1 to 6 per cent., and powders of 2 to 6 per cent. Care must be taken not to apply too-concentrated solutions to the irritated surfaces or the mucous membranes, as a very intense sensation of burning may be caused; and also not to make too extensive applications at once, on account of the disagreeable sensation of cold. As the itching is but a symptom of the disease, it is necessary to prescribe for the latter, as the menthol relieves only the itching. Colombini (Wiener med. Presse, May 7, '93).

Naso-Laryngeal Disorders.—Menthol may be used as a depletant on the mucous membranes of the nose or throat. It causes a contraction of the local blood-vessels, which, unlike the action of cocaine, is not followed by an increased dilatation. Dissolved in oil (6 grains to 1 ounce) or in albolene or blandin (5 grains to the ounce) it may be used in spray for the relief of acute coryza and the nasal form of hay fever. A mixture of menthol and carbonate of ammonium may be used for the same purposes, either being inhaled from a wide-mouthed bottle or an inhaling-tube.

Thirty-seven cases of diphtheria (in 3 adults and 34 children) treated successfully by painting with a 10-per-cent. alcoholic solution of menthol. The paintings (using cotton-wool) were usually carried out three times daily. In some cases, however, a single free application was followed by complete disappearance of false membranes within two days. A marked improvement in the patients' general condition was invariably noticed from the beginning of the treatment. F. Kastorsky (Wratsch, No. 24, '94).

Pulmonary Disorders.—Inhalations of menthol have been used with advantage in asthma. Being readily volatilized by the addition of hot water, the resultant vapor may be inhaled.

A few drops of a 20-per-cent. solution of menthol in olive-oil by inhalations administered to a woman with asthma and congestion of the head. Before administration crepitation and rhonchi were heard on pulmonary auscultation. The remedy always checked the asthmatic attack; breathing became normal, the heart's action remained unaltered, and the pulse full and strong. The patient sometimes complained of dizziness. Jores (Ther. Monats., Apr., '89).

Intralaryngeal injections of 10- to 15-per-cent. solutions of menthol in olive-oil or vaselin have been used in pulmonary tuberculosis and ulcerations of the

larynx. These injections often relieve the dyspnœa and cough associated with phthisis.

Menthol successfully employed in the treatment of pulmonary and laryngeal tuberculosis, according to the suggestions of Koshlakoff and Simanovsky. In 8 out of 12 cases it was found that: (1) the menthol treatment was followed by a great amelioration of the general condition of the patient; (2) the remedy improved the appetite, promoted easy expectoration, and gradually decreased the daily quantity of the sputa; (3) the drug never gave rise to any renal irritation; and (4) it never induced hæmoptysis. In the 15 cases of laryngeal tuberculosis treated with menthol, the drug was found to possess considerable analgesic action. The paintings decreased local inflammatory phenomena and did away with infiltrations. They also promoted healing of superficial ulcers, but could not, however, bring about cicatrization of deep ulcerations. It is advisable always to begin with a 10-per-cent. solution, and to gradually increase this strength. In all cases the local must be accompanied by general treatment.

In pulmonary tuberculosis the drug was administered internally, as in the following prescription:—

℞ Mentholi, 1 drachm.
Pulv. acaciæ sacchari albi, of each, $\frac{1}{2}$ drachm.

M. et ft. pil. No. 40.

Of these pills, 5 are to be taken, gradually increasing the number to 20, 30, and even 40. The inhalations were used from ten to twelve times a day. The paintings were applied with from 10- to 50-per-cent. solution, once daily, once every two days or twice a week, according to indications. Valerius Idelson (Wratsch, No. 3, '90).

Injection into the larynx of a 20-per-cent. solution of menthol in olive-oil advised in laryngeal and pulmonary phthisis. At each sitting two to three injections of 15 minims each should be given, the fluid being deposited on the part affected when the larynx is diseased, but in the trachea when the lungs only are involved. The procedure should be carried out once or twice daily for about two months. Ulcers of the larynx heal nicely under it. A. J. Beehag (Edinburgh Med. Jour., Jan., '88).

Attention called to the parasiticidal powers of menthol, a remedy that may be daily applied through the trachea in the treatment of pulmonary consumption, using doses of 1 drachm of a 12-per-cent. solution made with sterilized oil. Administered in this manner, the drug was well borne by patients, and under its use the cough, expectoration, night-sweats, the hectic fever, and even the emaciation were diminished. Brookhouse (Revue Gén. de Clin. et de Thér., Aug. 3, '92).

Ear Diseases.—Mentholized oil (10 to 15 per cent.) has been recommended in the treatment of furuncle of the external auditory canal, and of diffuse swelling of the wall of the canal. A pledget of cotton soaked in the mentholized oil is inserted into the meatus and left for twenty-four hours. A burning sensation is produced, but it soon passes off. In the painful stage of otitis media without perforation, mentholized oil (1 to 2 per cent.), instilled into the meatus, is a useful anodyne application. In chronic otitis media mentholized oil (5 to 10 per cent.) is valuable as a mild antiseptic for the interior of the tympanum.

Local Anæsthesia.—Squibb advises the following solution for local anæsthesia that will last about five minutes, an ordinary hand-spray apparatus being used:—

℞ Menthol, 2 parts.
Chloroform, 20 parts.
Ether, 31 parts.—M.

Equal parts of chloral and menthol form, upon trituration, an oily substance which is mildly counter-irritant and a local anæsthetic.

Mixture of equal parts of menthol and iodoform in the form of a dry powder

tried in fourteen cases of scraping out and resection of tuberculous bones and soft parts. In every instance the wound healed more rapidly, and the general course of the case was more favorable than in another series of similar cases where iodoform alone was employed. Girard (Brit. Med. Jour., Apr. 28, '88).

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MERCURY.—Mercury, *hydrargyrum*, or quick-silver, is a lustrous, bluish-silver-white metal liquid which, though occasionally found in its pure state, is usually obtained from native chloride or sulphide. It is also found in amalgamation with silver. The sulphide, called *native cinnabar*, is mainly obtained in the mines of Almaden, Spain, and of New Almaden, near San Jose, California. The various processes through which it is isolated are all based upon distillation.

Mercury is devoid of odor or taste. At the usual temperature of temperate countries it occurs as a heavy fluid, but at 38.88° below zero F. it becomes solid, though quite malleable. When it is exposed to high heat (675.05° F.) it volatilizes into a colorless vapor. It is soluble in nitric acid and boiling sulphuric acid.

Physiological Action.—BLOOD.—Wilbouchewitch showed that large doses of mercury caused reduction of the red blood-corpuscles and that small doses prevented their destruction. When, however, small doses were administered during too prolonged a period, anæmia was again observed. E. L. Keyes, in a series of experiments, further demonstrated that small doses of mercury not only arrested the destruction of corpuscles due to syphilis, but that they actually caused an increase which steadily progressed until a normal proportion was attained, as long as the small doses were given. Large doses he found to exert an opposite influence, being distinctly debilitating. Robin, acting on these conclusions, found that in syphilitic or non-syphilitic subjects, and whatever way it was administered, mercury always caused an increase of blood-corpuscles provided an intercurrent gastric disorder were not present or the untoward effects of mercury — salivation, etc. — were not produced. The onset of these disorders marked the beginning of hypoglobulia —decrease in the number of corpuscles.

Observations in regard to the amount of hæmoglobin present in syphilis in relation to the benefit derived from mercurial treatment. Three incontestable facts are (1) that if a syphilitic patient has no treatment, the quantity of hæmoglobin in the blood will diminish from time to time; (2) that if mercury be given to animals or persons not suffering from syphilis, the amount of hæmoglobin will be diminished in a few days; (3) that if a syphilitic person who shows that the amount of hæmoglobin is diminishing be put on a mercurial treatment, an increase in the amount of hæmoglobin can be determined at once, and very markedly in the course of seven or eight days. From these facts we have a valuable indication as to just when our mercury ceases to do good, and therefore should be stopped. Semmola (La Presse Méd., Sept. 15, '89).

The comparative influence of mercury upon the blood was recently studied by Kuperwasser (Arch. des Sci. Biol. de St. Petersburg, vol. vi, '98). He found that white corpuscles (which all arise from one and the same element,—namely: the small mononucleated lymphocyte) being classified into (1) young, (2) mature, and (3) old, leucocytes, the blood of healthy subjects was modified by mercury in that the proportion of young leucocytes present is considerably increased and that of the old considerably diminished. The blood of syphilitics reacts to mercury by a considerable diminution in the propor-

tion of young and a corresponding increase in that of old leucocytes. This reaction is independent of the stage of the disease, and takes place whether there are at the time syphilitic manifestations or not, and also whether the patient has or has not previously been subjected to specific treatment of mercury and iodides. Those who have undergone treatment by mercury within four months of applying the blood-test form the only exception to this rule. In such cases the reaction of syphilitic is replaced by that of healthy blood, possibly because the patient still retains a considerable quantity of mercury, or because under its influence the disease has become so attenuated that the blood gives a normal reaction.

Older observers had noted a diminution of fibrin, and as a result an abnormal fluidity of the blood that predisposed to hæmorrhage. Lowering of the rate and tension of the pulse and of the temperature, sometimes of nearly two degrees, was also noted: all evidences that the remedy had been administered in injudicious doses.

> Bichloride, in high toxic doses, exercises a noxious influence on both the white and red cells of the blood. In small amounts it affects the white corpuscles more markedly than the red bodies. The minimum fatal quantities for the organism correspond to the smallest amounts necessary to destroy the leucocytes; the same relation exists in regard to the largest quantities tolerated by the economy and those which are borne by the leucocytes; and it can be said that at present there is no histological element so susceptible to the influence of the drug in question as human leucocytes. E. Maurel (Bull. Gén. de Thér., Mar. 15 '93).

Kidneys.—The observations of Welander tend to show that the elimination of mercury through the kidneys is attended by more or less temporary irritation when the drug is administered for some time. Casts were found in the urine in all of his 97 cases, in proportion to the length of the treatment, gradually decreasing after cessation and disappearing within a month or six weeks. It is well to bear in mind, however, that his data are based upon observations in syphilitic cases, and that the disease may bear considerable influence upon the renal phenomena.

> Syphilitic patients under mercurial treatment frequently develop nephritis. Out of 100 patients, 8 had developed albuminuria in consequence of the absorption of mercury. These cases always tended to recovery on the cessation of the drug. Fürbringer (Med. Week, July 13. '94).

As regards the quantity of urine, various preparations were found, by Winternitz, to differ in no way. His experiments included the insoluble salts, calomel, salicylate of mercury, and the soluble preparations. A parallelism between the quantity introduced and the curative effect was shown by the quantity excreted, whether the mode of administration was by the mouth, subcutaneous injection, local inunction, or plaster.

Intestinal Tract.—Schuster, as already stated, found mercury in the fæces three months after cessation of the treatment. This author is of the opinion that the intestinal tract is far more active than the kidneys in the process of elimination, and that mainly through its means the system is, as a rule, relieved of its mercury six months after an average course of treatment. In poisoning by mercury the intestinal tract seems to bear the brunt of the attack, especially the large intestine. Pilliet and Cathelineau found extreme congestion of the vascular net-work, with necrosis of the glandular net-work, in this situation.

Fränkel found that the inflammation, even when mercury is used externally, attacked the large intestine and the ileum only exceptionally.

Anatomical specimens from a patient who had received hypodermic injections of metallic mercury. The intestine was dotted with numerous ulcers and diphtheroid thickenings, and the kidneys were of the small, white type. Audry (Lyon Méd., Apr. 15, '88).

Calomel has a marked disinfectant effect upon the intestinal canal, which depends upon the transformation of the drug into an oxide of mercury through the influence of the bile and the alkalies of the intestinal canal. Sawadsky (Jour. des Sci. Méd. de Lille, Mar. 16, '88).

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When calomel is given, even in therapeutic doses, and the subject is then made to drink saline or chlorhydrated water, much more rapid and intense symptoms are induced than when the calomel is administered alone.

In these cases it is probable that the calomel only acts while going through the albuminoid substances of the body; it irritates the digestive tube, giving rise, in the first place, to diarrhœa and vomiting and afterward to alterations in the mucous membrane. This toxic and irritating action of the calomel is, however, principally observed when it is in contact with substances which render it more soluble and more absorbable. Among these substances, chloride of sodium and chlorhydric acid, associated with various albuminoid substances, come first in order. These substances do not act by chemically transforming the calomel into a more toxic agent,—*i.e.*, corrosive sublimate,—but simply by facilitating its absorption in a mass. Ottolenghi (Gaz. Osped., No. 1, '97).

Nutrition.—Thirty years ago Liégeois stated that personal observations had led him to conclude that even in healthy men very small doses of mercury led to an increase of weight. Schlesinger, in a series of experiments in sheep, rabbits, and dogs, also noted this fact. Having administered the corrosive sublimate an entire year, he found that all the animals, especially the dogs, so treated had gained in weight and that there had been a marked increase of red corpuscles, while all the untreated check animals did not present these changes. Schlesinger contends, however, that the increase in weight being due to an increase of fat, the only conclusion warranted is that a diminution of oxidation occurs, the result of restricted protoplasmic metabolism, the red cells increasing merely because the destruction was curtailed. The tonic effects of mercury would thus, in his opinion, be but apparent; were they real an elevation of temperature and an increase of organic exchanges would be present. In the opinion of H. C. Wood, this view rests upon theory rather than upon demonstrated facts, there being much clinical testimony to sustain the assertion that exceedingly minute doses of mercury benefit nutrition. The fact that von Boeck found an increase—though slight—of nitrogen in the fæces and urine under mercury tends to sustain Wood's contention.

Absorption and Elimination.—Although there is no doubt whatever that mercury is absorbed and eliminated, the manner in which the process is carried on is not fully understood. H. C. Wood concludes from data at hand that "the single dose of mercury does not remain in the system, but that when the drug is administered constantly for a length of time elimination does not keep pace with absorption, so that the mercury accumulates in the tissues."

When applied to the skin, mercury has been traced microscopically as far as the hair-bulb, where it has thought until recently to become transformed into corrosive sublimate (Neumann). The

same chemical transformation was believed by many observers, including Nothnagel and Rossbach, to occur in the intestinal tract. In the presence of albuminous substances the new salt was credited with the power of forming an insoluble albuminate, which became soluble in the presence of chloride of sodium.

Recent labors, however, having demonstrated the extreme power of volatilization of mercury (it has an initial molecular velocity of 180 metres per second, according to Merget), and the theory has been vouchsafed that in its normal or metallic state it penetrated the cutaneous and intestinal mucous surfaces (Rabuteau; quoted by Jullien, "Maladies Vénériennes," p. 1161). The protiodide, for instance, would become transformed into metallic mercury and biniodide, the latter, in turn, being decomposed and giving rise to the iodide of sodium found in the urine; calomel would yield pure mercury and bichloride, which, in turn, would slowly be transformed into chloride of sodium and metallic mercury in the blood. Thus, any preparation of mercury would finally yield its original element. This theory, according to Jullien, of Paris, a syphilographer of extensive experience, is sustained by much clinical evidence. He alludes to the many instances in which metallic mercury has been found in various tissues (Van Swieten), the pus of abscesses (Maldore), bones (Hyrtl), etc.

As regards the accumulation of mercury in the organism, Vajda and Paschkis and Sigismund found it in the urine thirteen years after cessation of mercurial treatment, but Schuster attributed this result to faulty technique in the case of the first observers and to constant exposure of the subject to diffused mercury, in the case of Sigismund. Still, Schuster himself found it in the fæces months after the treatment has been stopped.

> In administration of the insoluble salts of mercury the metal may be found deposited in the following organs, those containing the larger amounts being first: Kidneys, liver, spleen, then the intestinal canal (which contains an increasing portion from the upper part downward), and in small amounts in the heart skeletal muscles, and, in some cases, in the lungs and in the blood collected in the larger vessels and the aorta. Karl Ullmann (Inter. klin. Rund., Sept. 25, '92).

As to its elimination, this depends upon the manner in which it is administered. Byasson and Betelli found mercury in the urine and saliva two hours after ingestion. Riederer obtained, from the fæces of a dog, 77 per cent. of the quantity administered during thirty days, and from its urine 1 per cent. The brain, heart, lungs, spleen, pancreas, testicles, penis, muscles, and liver were all found to contain mercury: the liver the most and the muscles the least. It has also been found in the milk of nursing-women, and their sucklings, and in semen. The experiments of Magencon and Bergeret would tend to show, however, that a single dose of mercury is completely eliminated.

> After a single dose of mercury its elimination is rapid and sometimes complete in twenty-four hours, but if a continuous treatment is interrupted its excretion continues for some time, and Küssmaul and Gorup-Bésanez have found it in the liver as much as a year after its administration had been stopped. The amount of mercury that can be steadily eliminated for many weeks from the kidneys when the body is saturated is about $\frac{1}{10}$ grain.
>
> The practical conclusions to be drawn from these researches is that it is well to stop the administration of mercury when the amount eliminated by the urine has reached its normal maximum. M. F. Balzar and Mlle. Klumpke (Revue de Méd., Apr., '88).

Untoward Effects of Mercury.—When there exists in the individual treated an unusual sensitiveness to mercury or the drug be given too long or in excessive quantities, symptoms appear that are quite pathognomonic. There is, at first, disagreeable metallic taste, the breath is fœtid,—the fœter of dead tissue,—the gums are sensitive, and when the jaws are forcibly closed slight pain is experienced. At the same time the saliva becomes more free than usual. If as soon as these symptoms appear the administration of the drug is not stopped, *as should always be the case*, the gums become spongy and bleed easily: the tongue swells, and the flow of saliva becomes excessive,—ptyalism. If the gums be examined, a dark line will be found at their junction with the teeth. The parotid and maxillary glands are usually enlarged and tender, and there may be slight fever.

Catharsis and mild ptyalism followed 2- to 3-grain doses of the yellow subsulphate of mercury (turpeth mineral), given to produce vomiting in a child of three years. Bradford Woodbridge (Occidental Med. Times, Mar., '91).

Case of salivation in a child from less than 2 grains of calomel. Krotoszyner (Occidental Med. Times, Mar., '96).

Case in which ptyalism was produced by the local application of black wash. T. J. Walker (Brit. Med. Jour., Nov. 28, '91).

Persistence in the use of mercury after these manifestations is followed by local destructive changes. Ulceration of the mucous membrane, soon invading the deeper tissues, looseness and loss of the teeth, necrosis of the jaw-bones, copious hæmorrhages occurring through ulceration of the vascular coats, follow in more or less rapid succession, and the patient dies of exhaustion. It is rare that such a result occurs nowadays. The cases of mercurial poisoning usually met with are usually due to insufficient instructions to the patient, who continues to use the remedy without consulting his physician.

In some cases the skin is first to show the mercurial manifestations, an eruption resembling that of scarlatina being that most frequently observed. Great suffering is sometimes entailed, as shown in Camescasse's case given below.

Case of a man, 45 years of age, in whom mercurial inunctions were followed by severe ptyalism, painful tongue, loosened teeth, fœtid breath, a papular and pustular eruption accompanied by intense itching, and a purpuraceous desquamation. The temperature was raised to 102° F., and there were produced also loss of appetite, tremor, albuminuria, and other symptoms. The patient finally recovered under proper treatment. He exhibited, some time later, the same train of symptoms after the administration internally of 10 grains of calomel divided in four doses. The eruption now was of a miliary and scarlatiniform character. The primary symptoms were chills and fever at night. Robinson (Med. Analectic and Epit., Aug., '90).

Instance of erythema scarlatinoides following the application of mercurial ointment to the pubic region in which diagnosis of scarlatina was made by a physician. Within a week there followed abundant desquamation from the entire body, especially profuse on the hands and feet. At no time was there an elevation of temperature nor was the throat implicated. Fordyce (Jour. Cut. and Gen.-Urin. Dis., Dec., '95).

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Case of an old woman, suffering from irregular heart-action resulting from a long-standing mitral insufficiency who received five doses of $^2/_3$ grain of calomel at three-hour intervals on alternate days for a week. Patient was upon a milk diet, and received a simple clyster each morning. Moderate purgation and considerable diuresis ensued, with consequent diminution of anasarca and dyspnœa. Upon the day following the first day's

use of the drug there was noticed a slight burning over the entire body, but especially over the face, neck, and hands. The second day redness appeared. At the end of the week the burning was atrocious, the entire surface of the skin was scarlet red, violet in places, swelled, and thickened. The hairy scalp remained uncolored. The palms and soles were less colored than the other surfaces, but yet were red. In a few days spontaneous cure appeared, but accompanied by an abundant and extraordinary desquamation, which extended to the hairy scalp and to the mucous surfaces. First, large surfaces were detached, then small scales, and finally a whitish powder. This process lasted fifteen days, although the mucous surfaces were healed at an earlier period. There was not any elevation of temperature, nor did the redness of the mouth resemble a mercurial stomatitis. Camescasse (Bull. Gén. de Thér., le. liv., p. 20, '98).

Untoward symptoms of mercurial poisoning do not only manifest themselves as a result of the therapeutic use of mercury; they are often brought about by the handling of mercury as an occupation or the inhalation of its fumes. This is termed "chronic mercurial poisoning."

Chronic Mercurial Poisoning.—When the metal is inhaled in the form of a vapor, the nervous system is most apt to suffer, and paralysis is a frequent sequel. The palsy may, after long exposure, come on suddenly or slowly; there is a sort of general tremor and great unsteadiness in all movements, including those involved in locomotion, and the skin becomes dark yellow or brown. Mental debility may appear, the precursor of an early demise. The manifestations often simulate chorea and paralysis agitans. The disease may assume various special forms, certain parts being more involved than others. In some wrist-drop is a marked feature, in others there may be a brachial or crural monoplegia, etc. The special senses are often impaired and disorders of sensation are frequently observed. Neuralgia is a prominent feature of these cases.

Case of typical polyneuritis following a prolonged course of inunction of mercury in the treatment of an attack of syphilis. Leyden (Deut. med. Woch., Aug. 3, '93).

Three cases of pronounced multiple neuritis from the therapeutic use of mercury. Recovery occurred in all. Spillmann and Etienne (Rev. de Méd., Dec. 10, '95).

Mercurial Cachexia.—This condition resembles scurvy and may result from professional exposure to the effects of mercury or as a sequence of treatment. There is marked anæmia and loss of flesh, alopecia, general loss of power and all the local manifestations of mercurial toxæmia: foul breath, diarrhœa, and a dark color of the skin. There is, besides, intense pain in the bones and joints, suggesting rheumatism.

Poisoning of Mercury.—Whatever be the preparation of mercury ingested in poisonous quantities, the symptoms are very similar, the only difference worth noting being the rapidity of onset. The majority of accidental cases met with are usually instances of bichloride poisoning. If the dose taken is large and concentrated, there is nausea, vomiting, faintness, impaired locomotion, and severe pain in the throat and chest. There is violent diarrhœa, cramps; at first the urine is freely voided; later on anuria occurs. The lips, tongue, and pharynx may be tumefied, and dysphagia be so marked as to prevent swallowing of remedies. After several hours the breath becomes excessively fœtid, great salivation occurs, and ulcers appear on the inner aspect of the lips and cheeks, and sometimes the tongue. The gums become spongy. Gradually the local symptoms become more marked and the pa-

tient dies. A fatal ending rarely occurs the same day.

Case in which a woman was poisoned through drinking, at one draught, a tumblerful of tepid water, in which a 5-per-cent. sublimate pastille had been dissolved. Immediately after drinking this she felt nausea, faintness, and weakness in the knees, so that she could not even crawl into bed. Directly she was placed in bed violent choking sensations set in and she vomited bile-stained mucus. One hour and a half after the poison was swallowed the symptoms mentioned had become aggravated. General trembling movements, especially marked in the upper part of the body, were present. The patient could not speak, but by signs expressed that she felt severe pains in the region of the stomach and pharynx and heaviness in the head. The pulse was rapid and soft, the temperature subnormal, the pupils contracted. She had taken a quart of milk, but found great difficulty in swallowing it. The whites of 3 eggs were given at once, morphine, and, later on, oil of camphor, being injected subcutaneously. The doses of albumin were continued every half-hour during the day. Temporary suppression of urine was noted, but the kidneys acted within twenty-four hours: tea and black coffee favored diuresis, but these fluids were usually vomited shortly after they were swallowed. The symptoms were very grave for several days. The vomiting ceased gradually; profuse salivation and ulcerative stomatitis set in on the third day, with bloody and slimy motions and scanty secretion of urine. Albumin and, occasionally, blood were detected in the urine. It was a fortnight before the patient was able to stand. She had become extremely emaciated, lost a great quantity of hair, and noted that her sight failed her. In about a month the patient was convalescent. Eisenhart (Centralb. f. Gynäk., Dec. 13, '90).

In a fatal case, that of a woman who had taken upon an empty stomach a large teaspoonful of corrosive sublimate in powder, Durante found the following anatomical changes: Subpericardial ecchymoses; enlarged liver, with subcapsular ecchymoses; pale, swelled kidneys, with small ecchymoses in the pelves; œsophagus reddened at its upper part, normal below; stomach showed a softened mucosa, with numerous ecchymosed patches and large, grayish ulcerations, most marked near the fundus; intestinal mucosa showed limited areas of deep reddening, with ulcerations, the changes in the large intestine being less than those in the ileum; the brain showed injection of the vascular meninges.

Lesion found in a case of poisoning by the cyanide of mercury to very closely resemble those seen in mercuric-chloride poisoning. As patient lived eight days after the taking of the poison, pathological changes were well marked. The lowest portion of the ileum was the most affected part of the digestive tract, and the kidneys were found to be impregnated with lime-salts to a marked degree. Virchow (Deutsche med. Woch., Nov. 29, '88).

Local applications of various preparations of mercury are no less toxic than when the drug is taken by the mouth.

Case of girl, aged 20 who sprained her wrist. A few days later lymphangitis apparently supervened, for which mercurial ointment was applied and rubbed into some cracks on the hand. An hour after the inunction the patient felt ill, fainted, and vomited. The same evening, there was much swelling of the hand and of the arm on its dorsal aspect. An incision was at once made into the brawny and gray-colored tissues. The next day, January 16th, there was vomiting, with tenesmus and slight albuminuria. Cultivation experiments were negative. On January 17th the vomiting was less frequent, but there was anuria. The stools were blood-stained, and the condition very like that of dysentery. There was no fever. On January 18th severe hæmatemesis occurred. Diarrhœa, with stools of almost pure blood, and anuria continued. On January 19th there were gangrenous gingivitis and glossitis, with moderate salivation. The prostration

was great, but the mind remained clear. The following day there was a feeling of weight, and then paralysis, in the extremities, and the patient died. There were small hæmorrhages and superficial sloughs in the mucous membrane of the lower part of the small intestine and the characteristic appearances of severe dysentery in the large intestine. In the kidneys there were well-marked necrotic changes in the epithelium, especially of the convoluted tubes. Sackur (Berliner klin. Woch., June 20, '92).

The recommendation of preparations of mercury for vaginal douching is attended with danger, owing to the large quantity of fluid injected. Rectal injections are still more dangerous, owing to the rapidity with which fluids are absorbed.

Case of mercurial poisoning from the application of vaginal tampons wet with a solution of about 1 in 1200 of corrosive sublimate in a case of flooding during pregnancy. G. T. McKeough (Canada Lancet, vol. xx, p. 225, '88).

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Patient injected into the rectum a solution of perchloride of mercury (B. P.) —1 in 2000—which had been ordered for the preparation of a vaginal douche. In half an hour she was seized with cramp-like abdominal pains, and a little later she was found collapsed and pale, with a rapid intermittent and weak pulse, the jaws tightly clenched, the eyes dull and anxious. She recovered within a week, though complaining of her teeth and gums. Salivation never occurred. Hall (Lancet, Jan. 9, '97).

Treatment of Poisoning by Mercury.—Albumin forms an insoluble albuminate of mercury; hence the whites of several eggs should at once be administered to the patient. As the albuminate is liable to be disintegrated after a certain time, however, the stomach should be evacuated soon after and washed out, using the stomach-pump. As soon as this is done more white of egg should be administered and left *in situ*. If none can be had, wheat-flour or milk may be used, the former being given with a little water, just enough to enable it to reach the stomach promptly. After this measure the symptoms are to be treated on general principles as they appear.

Three drachms of yellow oxide of mercury with 1 of the red, accidentally taken by a man, produced in three minutes violent vomiting, followed by diarrhœa. Milk and eggs were given, and the man recovered. Herbert G. Lee (Brit. Med. Jour., Sept. 28, '89).

General Therapeutics of Mercury.

Metallic Mercury.—Mercury itself is used in the following forms:—

Blue Mass. — The mercury is triturated with the excipients until the mercurial globules are no longer visible under a microscope magnifying 10 diameters. The mass thus prepared contains 33 per cent. of mercury. The dose is from 1 to 10 grains. The familiar "blue pill" should contain 3 grains, but this dose is sometimes exceeded.

Gray Powder. — Mercury with chalk, or hydrargyrum cum creta, is likewise a fine triturate, but it contains 38 per cent. of mercury and 57 per cent. of prepared chalk. Each grain of gray powder contains about $^1/_3$ grain of mercury. The dose in children is from $^1/_2$ to 2 grains.

Mercurial or *blue ointment* is prepared by triturating mercury with lard and suet until the mercurial globules are invisible as above. It contains about 50 per cent. of metallic mercury.

Mercurial plaster is a combination of metallic mercury, oleate of mercury (see Oxides), and lead plaster.

Therapeutics.—Metallic mercury is mainly employed as a cathartic in the form of blue pill. As such it is an excellent agent when hepatic torpor is present, though it sometimes proves irri-

tating to the intestinal tract. Nine grains, or three 3-grain pills, usually give rise to little, if any, griping. If this symptom is feared, however, a little opium may be added. It is customary to administer a saline purgative the next day to enhance the effect produced.

When a series of symptoms would indicate a bilious state of the system, occurring in persons over 40, especially women, and characterized by sleeplessness, the best results are produced by the use of blue pill. This acts distinctly as soporific. W. J. Tyson (Brit. Med. Jour., Jan. 31, '91).

Case of heart-failure of a year's standing, with increasing severity of symptoms, in which the administration of blue mass produced the most excellent results after other treatment had failed. The drug was combined with digitalis and sulphate of cinchonidine in the same proportion, 1 grain of each in every pill. Three pills were taken daily. Excellent results obtained with the same combination in cases of general œdema, as a result of weak heart simply or of organically diseased heart. Regulated diet and hygiene should accompany the use of the remedies. William Pepper (Univ. Med. Mag., Jan., '90).

Gray powder, or mercury with chalk, possesses much the same properties as blue mass, but it acts more mildly and is, therefore, considerably used in the treatment of children suffering from hepatic atony and the intestinal ailments resulting therefrom. The antacid power of the chalk adds to its value in the treatment of infantile diarrhœa with watery, colorless stools. It is also used in infantile syphilis with marked success, especially in syphilitic marasmus.

Mercurial ointment, besides its well-known value in the treatment of syphilis (*q. v.*), is also employed as an antiphlogistic and resolvent in inflammatory disorders of the joints. It is especially valuable when effusions and ankylosis are feared as a result of the local changes. Its antiphlogistic properties also manifest themselves in inflammatory processes of the peritoneum, and it is often used in peritonitis. The same may be said of orchitis and epididymitis, glanders, and other surgical mycoses.

Three cases of human glanders treated by gray ointment. The first case died the day after examination by the author. The other two received the infection from the first. Abscesses were incised and disinfected, and friction with the gray ointment, 1 drachm daily, prescribed. One and one-half ounces were used in the one case, and 6 1/2 ounces in the other. Cure resulted in both. Gralevsky (Wratsch, No. 25, '93).

Neapolitan ointment successfully used in treatment of malignant pustule. The ulcer was daily washed with sublimate, carefully wiped with cotton soaked in the same solution, in order to remove all the mortified portions, and covered with a piece of linen upon which the ointment had been spread. This dressing was removed only during the time required to wash the ulcer. Definite recovery took place within four or five weeks. N. Vertepoff (Medit. Oboz., No. 5, '94).

It is considerably used in the treatment of pediculi, or other parasites of the hairy regions of the body; but, as shown by Leidy, any fixed or volatile oil or even a bland ointment will act as effectually. Hence mercurial ointment should only be employed after trying the less dangerous preparations. If the former is used, care should be taken to avoid salivation.

Mercurial plaster may be used in the same disorders as the ointment and with the same objects in view. It is especially valuable in the treatment of splenic enlargements of malarial origin. It is also used to prevent pitting in small-pox.

Nitrates of Mercury.—The nitrate or pernitrate of mercury is only used in the preparation of a solution and an ointment.

Solution of acid nitrate of mercury, the

liquor hydrargyri nitratis, contains about 60 per cent. of nitrate of mercury and 11 per cent. of free nitric acid. It is used as a caustic.

Ointment of nitrate of mercury, the unguentum hydrargyri nitratis, or citrine ointment, contains about 7 parts of mercury, 18 parts of nitric acid, and 75 parts of lard-oil. It is not a stable preparation and should be freshly prepared.

THERAPEUTICS.—The solution of acid nitrate of mercury is a very active caustic, instantly penetrating the superficial tissues and especially phagedænic ulcerations. When, therefore, it is to be applied, the spot to be touched should be surrounded by a protective covering of vaselin, and a glass rod used for the application to precisely limit the amount employed. Any surplus should be washed off. It is extensively used for the destruction of syphilitic sores, benign and malignant neoplasms, lupus, epithelioma, noma, nævi, moles, warts, etc.

> Acid nitrate of mercury has been employed with success in the local treatment of nearly all unhealthy-looking sores. The preparation of the British Pharmacopœia, which is a syrupy fluid, is used. The acid should be applied with a brush, and care should be taken not to use too much of the drug, this being easily prevented by means of blotting-paper. Large scars can thus be avoided, especially in cases of acne of the nose. For large ulcers, patches of lupus, and for the tubercles and patches of syphilitic lupus, the acid can be applied more freely: and in these cases it must be left to act upon the part for two or three minutes before the blotting-paper is used. Caution should likewise be exercised with the drug, as indicated, when it is to be applied to the mouth, tongue, cheek, or throat. Hutchinson (Archives of Surg., Oct., '91).

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> Case of lupus vulgaris successfully treated by acid nitrate of mercury. The patient had suffered from lupus vulgaris of the nose for more than four years, and had undergone many scrapings. Acid nitrate of mercury, pure, had been applied on six occasions under cocaine anæsthesia, with the result that the parts had healed over soundly, no trace of lupous tissue being now visible. Sheild (Brit. Jour. of Dermat., Feb., '96).

The ointment of nitrate of mercury, citrine ointment, may be advantageously employed for deep-seated inflammations limited to restricted areas, when the superficial tissues are intact. It may thus be used to abort boils and felons

> Ointment of the nitrate of mercury successfully used as an abortifacient of boils and felons. In treating felons the entire finger should be covered with the coating of the ointment about ¹/₈ of an inch thick, and then wrapped with a piece of thick adhesive plaster. The dressing should remain twenty-four hours, after which no further treatment is necessary. R. Kenner (Med. Rec., Nov. 10, '88).

When, however, the ointment of nitrate of mercury is to be used in ulcerative processes, for which it is employed as an active stimulant, it should be diluted by the addition of an equal quantity of lard. In this strength it is especially useful in chronic disorders of the scalp, and is occasionally used in chronic eczema, psoriasis, and other cutaneous disorders of the body, but only when localized. Its application over large surfaces is dangerous.

Cyanide of Mercury.—*Cyanide of mercury,* hydrargyrum cyanatum, occurs in whitish crystals devoid of odor, but of metallic, bitter taste. It is principally used as a local antiseptic in 1 to 10,000 solution. It is very poisonous. The dose is $\frac{1}{12}$ to $\frac{1}{18}$ grain.

THERAPEUTICS.—The oxycyanide of mercury has been highly lauded as an antiseptic in surgery. It is well tolerated by the tissues, and is thought to be spe-

cially applicable to suppurating surfaces or to mucous membranes, as the conjunctiva, to render them aseptic.

As a disinfectant, especially when metallic instruments are to be used, oxycyanide of mercury is considered the best substance, since it does not in any way affect the latter, not even the edge of cutting instruments. A 3-per-cent. solution corresponds to a 2-per-cent. solution of corrosive sublimate, but a 1 to 10,000 solution has been found efficious for external uses. Monod and Malgaigne employed it successfully in hospital and private work and found that it possessed all the qualities of corrosive sublimate. It prevents the growth of cultures and kills developed cultures, including the bacillus coli, the bacillus pyocyaneus, streptococci, etc. The drug being exceedingly toxic, they never use large quantities at a time and avoid using it for washing out cavities.

Oxycyanide of mercury in 5 per 1000 solution displays in laboratory experiments an antiseptic potency always equal to and often greater than that of 1 to 1000 sublimate solution. It has no disadvantages other than those possessed by corrosive sublimate, and it has the special advantage of not affecting either the hands or the instruments of the surgeon. C. Monod (Le Prog. Méd., Oct. 26, '95).

Cyanide of mercury, highly recommended as an antiseptic for use by oculists, is efficient, though non-irritating.

The micrococcus pyogenes aureus is present in apparently perfectly healthy conjunctival sacs. The operation for cataract can be performed successfully without troublesome complications. Oxycyanide of mercury is a powerful antiseptic. Fourteen patients were treated by means of irrigation with a solution of the drug in the proportion of 1 part to 1500 of water. On subsequently submitting the conjunctival mucus to systematic culture, the tubes only remained sterile in 20 per cent. of the cases. The other tubes contained various microbes, especially the pyogenes aureus. Further experiments proved that the eyes could only be rendered thoroughly aseptic by eye-douches, repeated every few minutes for at least three days; the oxycyanide is superior to solutions of the bichloride, and is better borne by the conjunctiva. Chibret (Recueil d'Ophtal., p. 294, '89).

Literature of '96-'97-'98.

Preparations of mercuric cyanide may usefully be prescribed in the form of fomentations and collyria. A formula which is of daily use in cases of progressive choroidal atrophies in myopes and in disseminated forms of choroiditis in gouty persons is as follows:—

℞ Hydrochlorate of cocaine, 3 ¾ grains.
Cyanide of mercury, 4 ½ grains.
Cherry-laurel water, 6 ¼ drachms.
Distilled water, 8 ½ ounces.—M.

This same lotion may be used in certain forms of severe exudative and plastic choroiditis, as a subconjunctival injection. Galezowski (Recueil d'Ophtal., No. 12, '96).

It has been recommended as a safe agent for hypodermic use, but is an extremely dangerous remedy for intravenous injections.

Cyanide of mercury recommended in 1 to 2 solution for hypodermic use; the pain which it produces is insignificant. In this respect it is superior to the peptonate. J. Roussel (Jour. de Méd. de Paris, Mar. 25, '88).

Injections of 1-per-cent. solution of oxycyanide of mercury employed in the treatment of syphilitic conditions. Injections are well borne, little painful, and, used in over 1000 cases, has never caused untoward effects. Six or eight injections are equivalent to an energetic treatment by means of frictions. Chibret (La Sem. Méd., Apr., '90).

Internally it has been administered for syphilis and diphtheria, but in both of these diseases other remedial agents are to be preferred.

Great success obtained with cyanide of mercury in diphtheria; 1400 cases have been treated with it, with a death-rate of only 4.9 per cent. A teaspoonful of a 1 in 10,000 solution is given every quarter to one hour, according to the age of the child. H. Sellden (Wiener med. Presse., Apr. 8, '88).

Oxides of Mercury.—Yellow Oxide.—The yellow oxide of mercury, hydrargyri oxidum flavum, occurs as a yellow, fine, amorphous powder devoid of odor, but metallic to the taste. It is insoluble in water, and becomes darker on exposure to light. It is too irritating for internal administration and is mainly employed to prepare the

Ointment of yellow oxide of mercury or unguentum hydrargyri oxidi flavi, which contains 10 per cent. of the oxide. This is too strong for use in ophthalmic practice, however, and is usually reduced by the addition of lard, lanolin, etc.

Literature of '96-'97-'98.

Proper way of preparing the yellow-oxide-of-mercury ointment for use in ophthalmological practice. To the required amount of powder in impalpable form on a clean glass or porcelain slab, add a few drops of any bland non-irritating fixed oil, and mix well with a clean spatula; to this slowly add the necessary petrolatum. The following prescription in the hands of a competent pharmacist will be entirely satisfactory:—

℞ Olei ricini, 4 drops.
Hydrarg. oxidi flavi, 3 grains.
Misce et adde:—
Petrolati, 2 to 4 drachms.

The mass is so thoroughly homogeneous that not until it is kept for a long while will the mercury gravitate to the bottom. T. E. Mitchell (Ophth. Rec., Feb., '98).

It is also used to prepare the *oleate of mercury*, or oleatum hydrargyri, which contains 2 per cent. of the yellow oxide and 8 per cent. of oleic acid. It is used in preference to blue ointment by many practitioners.

The *red oxide of mercury*, or hydrargyri oxidum rubrum, occurs in the form of orange-red crystals, which, though carefully pulverized, always contain irritating particles. It is insoluble in water, and is not used internally. It is employed to prepare an ointment, the

Ointment of red oxide of mercury, but this has been advantageously replaced by the ointment of the yellow oxide, owing to the finer grain of the powder obtained from the latter.

Black wash and yellow wash, two official preparations considerably used as stimulants, depend for their virtues upon the black and yellow oxides formed. Black wash contains 1 drachm of calomel to a pint of lime-water; while yellow wash contains ½ drachm of corrosive sublimate to a pint of lime-water.

Therapeutics.—The yellow oxide enjoys the confidence of ophthalmologists in the treatment of blepharitis and conjunctivitis, owing to its antiphlogistic and alterative properties. In the acute form of the latter disorder an ointment containing 3 to 4 grains of the yellow oxide to the ounce is sufficiently strong, while disorders of the lids usually require a preparation four times that strength. The ointment should not, however, be allowed to come into contact with the conjunctiva. Corneal opacities and ulcers are also favorably influenced by the continued application of an ointment of yellow oxide of mercury.

Literature of '96-'97-'98.

Corneal ulcer successfully treated by the simple application of a salve of the yellow oxide of mercury, followed by an occlusive dressing. Sicherer (Rev. Gén. d'Ophtal., Nov., '96).

In affections of the skin it has been used with advantage in eczema and acne.

Erythematous pruritus of the anus is quickly arrested by its use.

Valuable ointment for anal pruritus is composed of 60 grains of red oxide of mercury with 450 of vaselin. Morain (Rev. Inter. de Méd., July, '95).

Literature of '96-'97-'98.

A very useful combination when much pustulation exists in acne is:—

℞ Ungt. hydrarg. oxid. rub., 3 drachms.
Ungt. sulphuris, 6 drachms.
Ungt. zinc. oxid., ad 2 ounces.—M.

G. T. Elliot (Post-graduate, Oct., '96).

The red oxide is mainly used to stimulate obstinate ulcerative processes, such as those occurring in venereal disorders. It is also employed in parasitic diseases of the skin.

Varicose ulcers of legs successfully treated with ointment of the red oxide of mercury. Officinal ointment too strong (1 part of the red oxide of mercury to 9 of vaselin); so that it was mixed with 1 to 2 parts of vaselin. Influence upon suppurating wounds was apparent in a short time. First day, patient complains of violent pains, which by the third have entirely or nearly disappeared. Dressing should be renewed once a day and the salve be spread upon a piece of cloth to the thickness of a knife-blade; a flannel or small bandage may be used to wrap the extremity. Rest in bed will accelerate the healing process. H. Langes (Münch. med. Woch., No. 48, '94).

Black and yellow wash are also mainly employed to stimulate chancres and syphilitic ulcers, the yellow wash being far more potent than the black. The latter is sometimes used in eczema.

The oleate of mercury is often substituted for a much more cleanly agent, blue ointment. The irritating action of the red oxide should be borne in mind, however, and it should be rubbed into the tissues in somewhat smaller quantities and with less rapidity. It is also employed in parasitic skin disorders, having replaced gray ointment in many of these, especially tinea tonsurans, pediculi corporis, and sycosis.

Iodides of Mercury.—The red iodide or biniodide of mercury, or hydrargyri iodidum rubrum, is a scarlet-red powder having no odor or taste. It is practically insoluble in water, and slightly soluble in alcohol. The dose is from $^1/_{32}$ to $^1/_8$ grain, administered in pill form.

Albuminous solutions of the biniodide remain clear for days, whereas with the bichloride of mercury an insoluble precipitate is formed. The solution for use is to be made with the iodide of potash. A jar containing bichloride solution and blood showed, at the end of six weeks, a few bacilli and micrococci, and its surface was covered with penicillium glaucum, while a similar jar containing biniodide solution was perfectly free from any change. G. Sims Woodhead (Proc. Royal Soc. of Edinburgh, '89).

An albuminous precipitate is always produced by the biniodide of mercury. The tartaric-acid solution of the bichloride of mercury, as originally proposed by Laplace, is the only antiseptic preparation of mercury which will not act in this way. Hare (Univ. Med. Mag., Sept., '89).

The solution of arsenic and iodide of mercury, the liquor arsenici et hydrargyri iodidi, Donovan's solution, contains 1 per cent. each of the red iodide of mercury and iodide of arsenic in distilled water. The dose is from 3 to 10 drops, largely diluted.

The green or yellow iodide of mercury, or protiodide, the hydrargyri iodidum flavum, is a yellowish-green, amorphous powder, devoid of odor or taste. It is decomposed by light. The dose is from $^1/_8$ to $^1/_4$ grain.

Therapeutics. — The red iodide of mercury is principally used in the treatment of syphilis (see Syphilis in volume vi), but it has also been found useful in various other disorders and as an

antiseptic in surgery, and in infectious disorders.

Biniodide of mercury dissolved in a solution of sodium iodide does not produce the unfavorable conditions that follow the use of the bichloride. Hanbury Frere (N. Y. Med. Jour., July 28, '94).

Sodic-iodide solution of mercury biniodide 1 to 2000 used for all amputation-flaps and recent wounds. Union is secured more firmly and rapidly than with carbolic-acid dressings. The firm and rapid union being attributed to the solution and removal of the two layers of effused fibrin, on the flat surfaces, by the fibrin-solvent sodic-iodide vehicle for the antiseptic agent. It has the advantage of being non-irritant, and it is rapidly eliminated by the kidneys. C. R. Illingworth (Satellite of the Annual, Jan., '92).

Mercury biniodide strongly recommended for washing out the abdominal cavity (in laparotomy), pleura (empyema), cerebral meninges (traumatic injuries), and synovial membranes (suppurative arthritis). No untoward effects ever seen. P. K. Bolshesolsky (Proc. of the Arkangelsk Med. Soc., v. ii, p. 19, '94).

Biniodide of mercury used in 6 cases of labor in which injections were indicated, in all of which the patients did well. A 1 to 4000 solution was used three to four times daily. It also acted well in a case of abdominal abscess intercurrent with typhoid fever, in a case of double laceration of the cervix, in abscess of the foot, in 1 of the axilla, and 3 cases of carbuncle. Enveloping the chest in a layer of biniodide-of-mercury wool relieves the pain in pulmonary disorders. Eugene P. Bernardy (Trans. Phila. Co. Med. Soc., Jan. 25, '89).

In the infectious fevers biniodide of mercury has been found of value both as a local antiseptic and as a general germicide.

Scarlet fever abated in five instances by the internal and external use of the biniodide of mercury. The disease has been prevented from spreading by painting the throat with 1 in 500 solution every four hours. In the cases reported the following formula was used:—

℞ Hyd. bichlor., ½ grain.
Potass. iod., 15 grains.
Sp. am. co., 1 drachm.
Syrup., ½ ounce.
Aq., 6 ounces.

M. Sig.: Half an ounce every second hour.

This was used in a child 9 years old. For local application the solution varied from 1 in 2000 to 1 in 500, to be used in the form of a spray or by painting with a camel-hair brush. C. R. Illingworth (Provincial Med. Jour., Jan. 1, '90).

Biniodide of mercury successfully used in the treatment of diphtheria and typhoid fever; the drug is an antiseptic and germicide of great value. For the first disease this formula was employed: biniodide of mercury, 2 grains; saccharated pepsin, 3 drachms. The powder is used as a local solvent and germicide, placing a quantity of it, proportionate to the age of the patient and the severity of the symptoms, on the tongue every hour. In addition to this treatment may be employed through insufflation, a powder containing 2 grains of the biniodide of mercury and 20 grains of trypsin, to be applied every four hours.

The administration of the remedy is regulated, then, by the gradual improvement. The efficacy of the drug was most satisfactory in laryngeal cases. In cases of typhoid fever, especially if the treatment was instituted early, the drug produced satisfactory results. Disease was abated by employing the drug in the prodromic period. For this purpose, as for the treatment of the disease when present, a mixture of $\frac{1}{20}$ to $\frac{1}{10}$ grain, and 10 grains of saccharated pepsin was given every four or six hours. B. F. Ackley (Pittsburgh Med. Review, June, '90).

Protiodide of mercury in $\frac{1}{10}$ grain pills recommended for typhoid fever. Holmstreet (Jour. Amer. Med. Assoc., Apr. 17, '97).

Biniodide of mercury precipitating tyrotoxicon in liquids, it has been recommended as an antidote in ptomaine poisoning.

The biniodide of mercury precipitates and renders inert the milk or cheese

ptomaine: tyrotoxicon. Luff (Lancet, Dec. 20, '91).

Employment of the biniodide of mercury recommended in cases of ptomaine poisoning. A. Hanbury Frere (Provincial Med. Jour., Mar., '92).

The green or yellow iodide is mainly employed in syphilis (*q. v.*).

The solution of arsenic and mercuric iodide is much esteemed in the treatment of chronic disorders of the skin: leprosy, lupus, etc. It is also advantageous in chronic gout and rheumatism as a general alterative and tonic.

Chlorides of Mercury.—The mild mercurous chloride, hydrargyri chloridum mite, calomel, is a tasteless, white, impalpable powder, insoluble in water and alcohol. Its dose varies from $^1/_4$ grain to 10 grains or even much more, according to the disorder treated.

The mercuric chloride, hydrargyri chloridum corrosivum, or corrosive sublimate, is prepared by subliming the bisulphate of mercury with chloride of sodium. It occurs in the form of transparent, whitish crystals, of a metallic, acid taste, and is soluble in sixteen parts of cold and two parts of boiling water, and in three parts of alcohol. Its dose varies from $^1/_{100}$ to $^1/_8$ grain.

Ordinary water causes an immediate decomposition of bichloride of mercury; this decomposition steadily continues under the influence of air and light. This decomposition ceases or becomes arrested when the air and light are excluded. Solutions of bichloride of mercury made in distilled water undergo only trifling decompositions, even when exposed to air and light. Bureker (Archives de Méd. et de Pharm. Milit., Apr., '95).

Sublimate solutions should be kept in brownish-yellow bottles, in order to prevent the decomposition which ordinary light gradually produces. H. Michaelis (Zeits. für Hyg., Aug. 23, '88).

Bichloride undergoes chemical change when in contact with organic matter, and is immediately converted by albumin into an insoluble albuminate. A small quantity is soluble in excess of albumin, but is likely to be at once decomposed, in masses of excreta, into the insoluble sulphide by the sulphuretted hydrogen present. W. B. Hills (Boston Med. and Surg. Jour., Feb. 21, '89).

Therapeutics of Calomel.—As a purgative, calomel is still considerably employed, though slow in action and occasionally unreliable. The possibility of retention under such circumstances renders mercurial absorption possible when a large dose is administered, and it is always prudent to administer a saline the next morning or to give another purgative at the same time—a poor recommendation for the primary drug. The compound cathartic pill is based upon this principle. Recent labors have severely shaken the general belief that calomel increases the flow of bile, and tend to confirm the view that as a true purgative there are many agents, especially podophyllin, that are preferable. Its germicidal action may render it useful, however, in the presence of infectious processes. In diphtheria, for instance, it is useful and it will sometimes check the disease when administered, but this can hardly be credited to its merits as a purgative.

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Effect of calomel on the secretion of bile as the result of experimental research on dogs with biliary fistulas. Oil has a negative effect on the secretion of bile, calomel a decided inhibitory effect, and salicylate of sodium, while it increases the quantity of bile secreted, lowers the density: the salts, etc., are reduced below the normal amount. The only active cholagogue is bile itself, the ingestion of which is always followed by a considerable hypersecretion of bile. Boyon and Dufour (Presse Méd., Oct. 13, '97).

Purgative effects are obtained with more certainty and with no danger of

ptyalism when very small doses, $^1/_8$ to $^1/_2$ grain, are administered every half-hour until 3 grains are taken. All the mercury thus ingested undergoes transformation into the purgative salt in the intestinal tract, and there is no surplus to awaken toxic symptoms later on.

> In the albuminuria of pregnancy, if there is need of a purgative, it is better to prescribe calomel. Huchard (Jour. des Prat., No. 1, '95).

Large doses of calomel have been recommended in the early stages of acute febrile diseases, pleurisy, pneumonia, yellow fever, and even in such affections as cholera. More clinical experience is necessary to confirm this view, but it seems to be in accord with data upon the physiological action of the remedy.

The same indications apply to the use of calomel in jaundice, or biliousness due to exposure to cold, the action being probably derivative and germicidal, to say nothing of stimulating powers which minute doses of mercury are known to possess.

In children very small doses thus become extremely valuable when general inaptitude is associated with "heavy" breath and usually ill-smelling stools. Four doses of $^1/_{25}$ grain every half-hour until five doses are taken, repeated in four or five days if needed, sometimes changes the entire aspect of the child. It is best administered thoroughly mixed with a little sugar, the powder being merely placed on the tongue. The tonic action of the remedy plays an important rôle here—provided only minute doses are adhered to.

In infantile diarrhœa this treatment is invaluable, but $^1/_{20}$ grain should be administered every three hours. As an anthelmintic it may also be used with considerable advantage.

Diphtheria.—In this disease calomel may be employed advantageously in three ways. As a preventive it has been highly recommended by Daly, of Pittsburgh. It is to be administered in small doses until its action upon the intestinal tract is shown by characteristic stools.

> Calomel is valuable in diphtheria: it is the best remedy we possess for promoting absorption, and is a safe and efficient germicide. Of thirty children treated by this method only two cases were fatal. G. B. Fowler (Obstet. Gaz., Jan., '88).

Fumigations are also valuable, the calomel being volatilized under a tent formed by sheets arranged over a frame inclosing the bed. It tends to soften the soft membrane to facilitate its detachment, while acting as a germicide.

> Diphtheria treated by mercurial fumigations. For a child of 8 to 10 years 40 to 60 grains of calomel are volatilized under a suitable tent or canopy, this being kept over the child 20 minutes. This procedure is repeated every 2 to 3 hours during the first day. The process is continued at the rate of 2 to 3 times a day for a week if the cough tightens again. The lamp should be powerful enough to volatilize rapidly, so that the temperature under the canopy may not be unpleasantly elevated. J. Corbin (N. Y. Med. Jour., vol. xlvii, p. 261, '88).
>
> Calomel fumigations of value in croup. The indications of this treatment are recession of the suprasternal notch during inspiration, with retraction of the infra-thoracic walls, stridulous breathing, hoarseness or aphonia at times, and lividity of the surface resulting from the deficient oxygenation of the blood. The amount of the mercurial salt to be vaporized varies from 5 to 20 grains, repeated at intervals varying from one half to two or three hours, according to the severity of the symptoms—in the average case 15 grains hourly. The patient is to be kept in the vapor-saturated atmosphere within a tent, for a period varying from ten minutes to half an hour. Fruitnight (Arch. of Ped., June, '95).

All the mercurial preparations possess diuretic properties, but these are especially marked when calomel is employed.

The increase of urine may range from a few ounces to as much as 370 ounces (Jendrassik). When administered in moderate doses repeated every three or four hours, the diuretic action appears early in some cases and only after four or five days in others. According to Lipari, tolerance for calomel is greatest in those cases in which diuretic action is most rapidly produced. On the contrary, the tolerance is least in those instances where the production of diuresis is retarded. The main untoward feature of its use is the marked tendency to cause ptyalism and other manifestations of mercurial intoxication. Hence the patients should be carefully watched. Calomel is especially efficacious in dropsical conditions of cardiac origin.

Six doses of 1 1/2 grains each may be given during the day, one every three hours. In cases in which there is a comparatively small cardiac lesion with marked dyspnœa and hypertrophy or dilatation, with albuminuria, œdema, and ascites, this treatment is useful. After the first few doses have been given, as a rule, an increase in diuresis is established, and on the second or third day quite copious evacuations of the bowels take place. There is marked improvement in all the symptoms, cardiac and otherwise. Even when the calomel is no longer administered these good results persist for from twenty-four to forty-eight hours. In order to prevent excessive salivation, or to relieve it when already produced, the following mouth-wash is used:—

℞ Chlorate of potas., 2 1/2 drachms.
Tannic acid, 4 grains.
Distilled water, 10 ounces.—M.

The calomel does good by relieving the congestion of the liver and the renal circulation, thus indirectly reducing the resistance to the heart produced by arterial pressure. At the same time an absolute milk diet is ordered. Of 107 cases of grave cardiac disorder with distressing symptoms of failure of the heart, treated in this manner by Moraldescu there were 14 deaths: 2 died of pneumonia after the heart-symptoms were relieved; 3 died before the treatment had sufficient opportunity to be tried; the remaining 9 were of advanced years and the disease was also far advanced.

Mercury is especially of value when there is no concomitant renal or hepatic disorder, and hurtful, according to Huchard, when the urine contains albumin.

> Calomel is a very valuable diuretic in the dropsy of heart disease, but useless in that depending on renal or hepatic affections. Two and one-half grains are given four times a day until ten doses are taken. The increase in the secretion of urine does not appear until the third or fourth day. Should no result follow in four days the treatment is stopped, to be recommenced after eight days. If successful on the first trial, a second course of ten doses is carried out after two to four weeks. H. Nothnagel (Ther. Monats., May, '88).

> In a desperate case of mitral regurgitation, accompanied with great dyspnœa, œdema, constant gastric pain, and scanty urine, digitalis had signally failed to give relief. Excellent results were obtained from the use of calomel in 10-grain doses at a time, administered on alternate nights. All the distressing symptoms disappeared gradually, and in fifteen days the patient was in comparatively good health. William Carter (Liverpool Medico-Chir. Jour., Jan., '91).

> The best results from mercury are seen in œdema resulting from cardiac failure. Diseases of the kidneys limit or entirely abolish the diuretic action. It is important that full doses be given, as small amounts are not diuretic. For the first two days the secretion of urine is diminished, but afterward it is augmented. Action of the drug is due to the irritation which it produces while passing

through the kidneys. W. Bieganski (Archiv f. klin. Med., Sept., '88).

Calomel is useless in cardiac diseases complicated with cirrhosis, and hurtful in renal or heart disease if albumin be present in the urine. H. Huchard (Revue Gén. de Clin. et de Thér., Apr. 25, '89).

Continuance of the treatment during diuresis will not alter or increase the effect. Its action is most marked in dropsies due to heart disease. Its action in dropsies of hepatic origin is not to be relied upon. Pathological changes in the kidney prevent or abridge its action. Small doses will prove of no avail. The diuretic action may, in all probability, be ascribed to the irritating effect which the mercury, during its elimination, exercises upon the renal epithelium. G. A. Fackler (Jour. Amer. Med. Assoc., Aug. 16, '90).

Calomel is an excellent diuretic, and is especially useful in cardiac dropsy. The action is greater in the absence of renal complications. Dosage must be guarded (maximum 1 ⅞ grains every two hours) and first symptoms of mercurial poisoning closely noted. In case of a weak heart, a combination of calomel and digitalis recommended. Finkelstein (Inter. klin. Rund., July 25, '95).

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Calomel is the best cardiac diuretic, if given in suitable doses and for a sufficient length of time. It may be given in severe cases of dropsy due not only to valvular disease, but also to cardiac failure from fatty degeneration, atheroma, and myocarditis. In fatty heart it is a specific, as it not only causes profuse diuresis, but causes the absorption of fat. When using calomel as a diuretic it should be given for six to eight days in about 1-grain doses five times in twenty-four hours, at intervals of three to four hours. Profuse diuresis sets in, as a rule, on the fifth day. When this occurs, calomel should not be abandoned, but continued till dropsy quite disappears. On the sixth or seventh day, when diuresis is fully established infusion of digitalis may be prescribed with additional benefit. If the dropsy has not disappeared after the first course (eight days) the treatment may be repeated after a pause of eight days. Thirst may be allayed by sucking pieces of ice. Large consumption of fluids should be avoided. Mild stomatitis, gingivitis, colic, bloody stools, hoarseness, etc., need not interrupt the calomel treatment. Should, however, diarrhœa be severe, the dose may be reduced to three or four powders a day. Arbold Landau (Wiener med. Presse, No. 29, '97).

Calomel has also been used as a diuretic in renal hepatic disorders, but the clinical reports have been contradictory. Its behavior in the treatment of cardiac disorders would tend to demonstrate that renal lesions inhibit diuresis: hence it is doubtful whether it can even be prescribed with safety.

Mercury acts as a diuretic, especially in cardiac troubles, while it is of little or no use in dropsies of renal origin, or in hepatic ascites and pleural effusions. Jendrassik (Deutsches Archiv f. klin. Med., B. 10, H. 7, '91).

In seven out of fourteen cases of well defined Bright's disease, accompanied with œdema, calomel was found superior to all other diuretics. Sklidowski (Deutsches Arch. f. klin. Med., B. 52, H. 3, 4, '94).

In ascitic hepatic disorders, especially cirrhosis, the results reported seem to warrant a further trial of calomel as a diuretic. As small doses are recommended, it can safely be administered.

Excellent results obtained from calomel in a case of hypertrophic cirrhosis in a man of 30 years. During the first month 1 grain was given six times a day (every two hours), every three days of treatment being followed by three days of repose. The second month, four doses per day were given for three days, and again followed by three days of repose. The pain ceased, icterus disappeared, and there was a notable diminution in the size of the hypertrophied liver and spleen. Iodide of potassium entirely failed in this case. L. Sior (Berliner klin. Woch., No. 52, '92).

In those cases of biliary affections, as calculi and catarrhal icterus, and even in hypertrophic cirrhosis of the liver, in which the usual treatment fails, the use of calomel recommended. It must be given in doses of 1 grain every hour for five consecutive hours, and the same dose continued every two hours until the pain disappears and the temperature returns to normal. Zakharine (Medycyna, No. 1, '91).

In gall-stones and diseases of the biliary passages calomel acts not by increasing the biliary excretion, but by its disinfecting properties, thus diminishing the abnormal irritation of the mucous membrane of the gall-bladder. V. Schultz (Berliner klin. Woch., No. 6, '94).

Calomel has recently been used with advantage in lupus. It was given hypodermically in small doses.

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Case of a woman, with tuberculous lupus of the face, in which a cure followed the use of injections of calomel. Fournier (Ann. de Derm. et de Syph., No. 5, '97).

Fourteen out of twenty-five cases of tubercular lupus in which calomel treatment has been tried, all the injections have been made with $^3/_4$ grain in the buttocks; at first, on the average, about ten in ten days; then longer intervals were necessary, owing to pain, induration, etc. The action of calomel upon true tubercular lupus is certain and indisputable. Improvement is most marked after first injections. This treatment appears to be of use in old ulcerated tubercular lupus, turgescent, with profound infiltration. The more superficial forms and lupus erythematosus are less affected. Asselbergs (Ann. de Derm. et de Syph., Jan., '98).

Local Uses. — Calomel was at one time considerably used locally as a stimulant in chronic inflammatory and ulcerative processes of the skin and mucous membranes, particularly in chronic eczema, herpes and syphilitic eruptions, and phlyctenular conjunctivitis, atrophic rhinitis, syphilitic laryngitis, etc. Since, however, its toxic effects have been better understood, the indiscriminate use of calomel thus involved has greatly decreased. When used in phlyctenular conjunctivitis, iodide of potassium should not be used simultaneously, an irritating compound being formed with what portion of the iodide is eliminated with the lacrymal secretion.

Therapeutics of Corrosive Sublimate.—Aside from its uses as an antiseptic (see Wounds, volume vi) and in syphilis (see article on Syphilis), the useful applications of corrosive sublimate are very similar to those of calomel, but, of course, in doses commensurate with its greater strength. Here, again, the activity of mercury as a tonic becomes manifest, provided very small doses are adhered to.

In the summer diarrhœa of children and adults very small doses are especially effective, $^1/_{100}$-grain doses being repeated every hour or two. It stimulates the intestinal tract and acts as a germicide, thus arresting putrefaction, and rids it of its contents by gentle catharsis. It has also been found valuable in dysentery, administered in somewhat large doses. Corrosive sublimate has also been used with advantage by rectal injections in the latter disease.

For the treatment of dysentery, enemata of bichloride of mercury successfully employed in cases where ipecacuanha had failed, and where the patients complained from the beginning of nausea and vomiting. Two hundred and two patients were treated by calomel by the mouth and enemata of bichloride of mercury. To those who had no gastric intolerance calomel was given in minute doses at first. For others the enemata of the mercuric salt were as follow: Of a solution of the corrosive sublimate, 1 part to 5000, three enemata of 6 $^1/_4$ ounces each were employed per day at first.

Later on, only one enema of 3 to 1000 parts was administered during the day. The enemata should be given lukewarm, and for some patients a few drops of laudanum may be added to the injections. Lemoine (Amer. Practitioner and News, Mar. 29, '90).

Bichloride of mercury successfully employed in dysentery. Solution of 1 in 6000, or $\frac{1}{2}$ grain to 6 ounces of water, was given by rectal injection. Of seventy-five cases recently treated there were but three deaths, all the others being completely cured. Roudneff (Medit. Oboz., No. 20, '93).

Mercuric bichloride has been found efficacious in the active manifestations of gonorrhœa, especially in women, and in gonorrhœal rheumatism.

Subcutaneous injections of the bichloride of mercury highly recommended for the treatment of gonorrhœal rheumatism. Jullien (La Sem. Méd., May 16, '91).

For gonorrhœal vulvitis every part should be painted every day thoroughly with a solution of silver nitrate (20 grains to the ounce). In cases with tender mucosæ, as in blonds and very young women, every other day is sufficient. To prevent extension the vagina is to be packed with iodoform gauze, previously wrung out in 1 to 5000 bichloride solution, and this must be renewed once in three days. The vulva should be bathed every four hours in a lysol solution. Pryor (Amer. Gyn. and Obst. Jour., Sept., '95).

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Treatment of rectal gonorrhœa in women consists in irrigation of the rectum twice daily, through a speculum, with a 3-per-cent. solution of boric acid, followed by mercuric chloride, 1 to 8000, half a litre of each being used. The erosions are touched with argentamine, 2 per-cent. solution. Baer (Deut. med. Woch., No. 8, '96).

It has also been highly recommended for the treatment of diphtheria, $\frac{1}{100}$ grain being given every three hours; but antitoxin is a much more effective agent and should be given the preference.

On the whole, the internal administration of bichloride in other than syphilitic affections has not received much support from the profession, owing to the fear of causing salivation and other manifestations of mercurial poisoning. Calomel has usually been employed, though, in truth, this agent is more liable to give rise to toxic symptoms than the bichloride.

Literature of '96-'97-'98.

Uniform success with mercury in cerebro-spinal meningitis: $\frac{1}{10}$ grain of mercuric chloride hypodermically at first and then $\frac{1}{20}$ grain every hour until there are symptoms of gastro-intestinal irritation. Smith (Jour. Amer. Med. Assoc., June 13, '96).

Good results from mercury in 9 cases of cerebro-spinal meningitis occurring in an epidemic of grip. Only 1 case proved fatal. The dose varied from $\frac{1}{10}$ to $\frac{1}{5}$ grain of the bichloride according to the age of the patient, administered hypodermically once in twenty-four hours in the beginning and later once in forty-eight hours. Consalvi (La Sem. Méd., Jan. 15, '96).

Case of pernicious anæmia in which mercuric-chloride injections were used, $\frac{1}{10}$ grain being administered daily for two months. Under this treatment the anæmia disappeared and the patient improved in every way. Patera (Riforma Med., May 28, '96).

Three cases of severe anæmia in which injections of mercuric chloride and quinine were used with good results. De Francesco (Gaz. degli Osped., Feb. 1, '96).

Local Uses.—The external uses of bichloride of mercury, besides its application to the operative field, are very numerous.

Surgical Abscesses.—In the treatment of furunculosis or boils, it is extremely valuable and often succeeds in arresting them when used early. Compresses of

a 1 to 500 solution applied over the spot —or, when the furuncle shows its first signs on an extremity, baths of this strength—are very valuable. The threatened region should be kept moist with the solutions, however.

As infection takes place from the outside, the following treatment is successful: The entire skin is cleansed by a warm bath with soft soap. The furuncle and the surrounding skin are washed with a 1 to 1000 solution of mercuric chloride. The boil is then covered with phenol and mercury plaster-mull, and the patient puts on clean linen. Twice a day new plasters are applied, and if the furuncle has opened the pus is gently squeezed out and the entire region carefully disinfected with the mercuric solution. Van Hoorn (Monats. f. prakt., B. 19, No. 1).

In onychia maligna, malignant pustule, and anthrax these applications are also of great value. The effect is enhanced by using warm solutions. It is also used with advantage in many skin disorders, including those attending infectious fevers. In small-pox it is quite effective in the prevention of pitting.

New way to use mercury, especially the corrosive sublimate, for preventing the pitting of small-pox: A solution of the salt is to be supplied by means of an atomizer in the following manner: For the first or second day of the eruption, the face is to be washed with soap and water, rinsed with borated water, and wiped dry with absorbent cotton before using the atomizer. After the third day the washing is unnecessary; the eyes are now protected with borated wadding, and the solution applied with the atomizer. In this way the skin is given a frosty appearance, and the danger of blistering by too copious a dose is avoided. The spray is to be applied chiefly to incipient pustules. Fifteen minutes after this operation of atomizing, which should not last more than a minute, the face is to be rubbed with a pledget of wadding dipped in a glycerin solution of sublimate of the strength of $^1/_2$ drachm to the ounce, the operation to be repeated three or four times during the twenty-four hours in the first three days, twice until the sixth or seventh day, when the spray may be suspended and the glycerin painting continued until the scabs begin to drop off. Results were highly successful except in cases of confluent small-pox; salivation never occurred.

The spray-solution is made up as follows:—

℞ Corrosive sublimate, 15 grains.
Citric acid, 15 grains.
Alcohol, 90°, 75 minims.
Ether, q. s. to make 12 $^1/_2$ ounces.
—M.

This solution contains 2 per cent. by volume of sublimate. Talamon (Ther. Gaz., May, '90).

The bichloride of mercury is employed locally in many diseases, and is introduced under each general heading.

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